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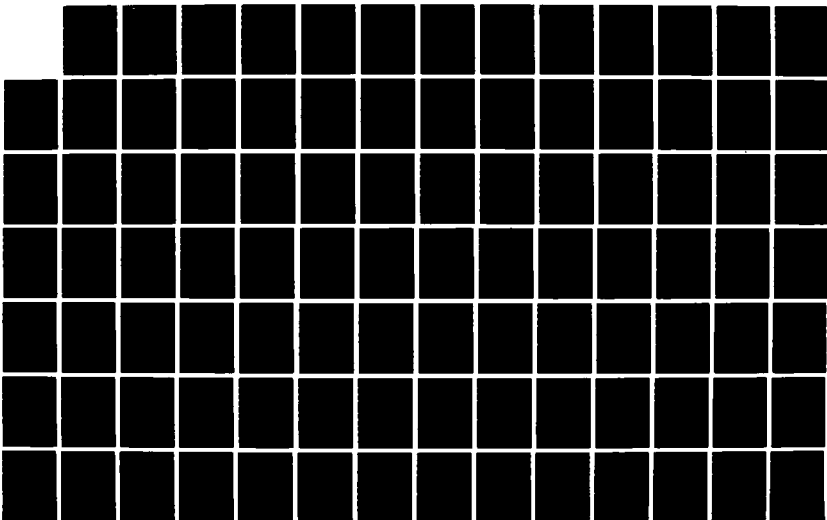
VERTICAL DIRECTIONALITY OF AMBIENT NOISE AT 32 DEG N AS 1/2
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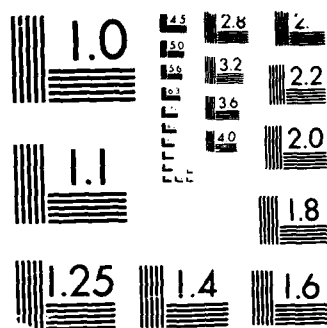
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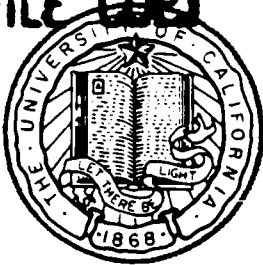
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MARINE PHYSICAL LABORATORY

SCRIPPS INSTITUTION OF OCEANOGRAPHY

San Diego, California 92152

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VERTICAL DIRECTIONALITY OF AMBIENT NOISE
AT 32° N AS A FUNCTION OF LONGITUDE:
Tape #86060

W. S. Hodgkiss and F. H. Fisher

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MPL TECHNICAL MEMORANDUM 387-C

MPL-U-32/86

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January 1988

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Vertical Directionality of Ambient Noise

at 32° N as a Function of Longitude:

Tape #86060

W.S. Hodgkiss and F.H. Fisher

Marine Physical Laboratory
Scripps Institution of Oceanography
San Diego, CA 92152

Abstract

Measurements have been made of the ambient noise field between 25 and 300 Hz with vertical arrays at 32° N (124° W, 136° W, and 150° W). This technical report contains the complete analysis results for the MPL 27-element vertical array Tape #86060. The tape was recorded at 32° N, 124° W (approximately 350 nmi due west of San Diego) on 27 April 1986 beginning at 06:34 PDT. At that time, the wind speed was 22 kts.

I. Introduction

This technical report contains the complete analysis results for the MPL 27-element vertical array Tape #86060. The tape was recorded at 32° N, 124° W (approximately 350 nmi due west of San Diego) on 27 April 1986 beginning at 06:34 PDT. At that time, the wind speed was 22 kts.

A complete description of the experiment and data analysis procedure is given in the summary technical report (TM-387-A). Here, a brief guide will be provided to the results documented in the various sections.

Section II (Preliminary Analysis) provides a preliminary look at the data quality from 4 hydrophones spaced approximately equally across the array for the first data segment (65536 points). The results are ordered as follows:

- (1) Channel means (A/D counts).
- (2) Time series (A/D counts) for the first 1024 points of the first segment.
- (3) Time-varying mean (A/D counts, 64-point averages).
- (4) Time-varying power (A/D counts squared, 64-point averages) (channel means have been removed).
- (5) Power spectra (dB// μ Pa/ $\sqrt{\text{Hz}}$) (channel means have been removed).

Section III (Power Spectra) provides an extended preliminary look at the power spectra from all hydrophones in the array for the first data segment (65536 points). The results are ordered as follows:

- (1) Channel means (A/D counts).
- (2) Power spectra (dB// μ Pa/ $\sqrt{\text{Hz}}$) (channel means have been removed).

Section IV (Array Response: Waterfall, KB Window) provides waterfall plots of the time-evolving vertical directionality of ambient noise for successive segments (65536 points) across the entire data tape (dB// μ Pa/ $\sqrt{\text{HzDeg}}$). A Kaiser-Bessel window ($\alpha = 1.5$) was used to amplitude shade the array elements.

Section V (Array Response: Waterfall, Rect Window) provides waterfall plots of the time-evolving

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vertical directionality of ambient noise for successive segments (65536 points) across the entire data tape ($\text{dB}/\mu\text{Pa}/\sqrt{\text{HzDeg}}$). A rectangular window was used to amplitude shade the array elements.

Section VI (Array Response: Panels, KB Window) provides multi-panel plots of the time-evolving vertical directionality of ambient noise for successive segments (65536 points) across the entire data tape ($\text{dB}/\mu\text{Pa}/\sqrt{\text{HzDeg}}$). A Kaiser-Bessel window ($\alpha = 1.5$) was used to amplitude shade the array elements.

Section VII (Array Response: Panels, Rect Window) provides multi-panel plots of the time-evolving vertical directionality of ambient noise for successive segments (65536 points) across the entire data tape ($\text{dB}/\mu\text{Pa}/\sqrt{\text{HzDeg}}$). A rectangular window was used to amplitude shade the array elements.

II. Preliminary Analysis.

Channel #1

1 12.944747924805

Channel #10

1 14.547775268555

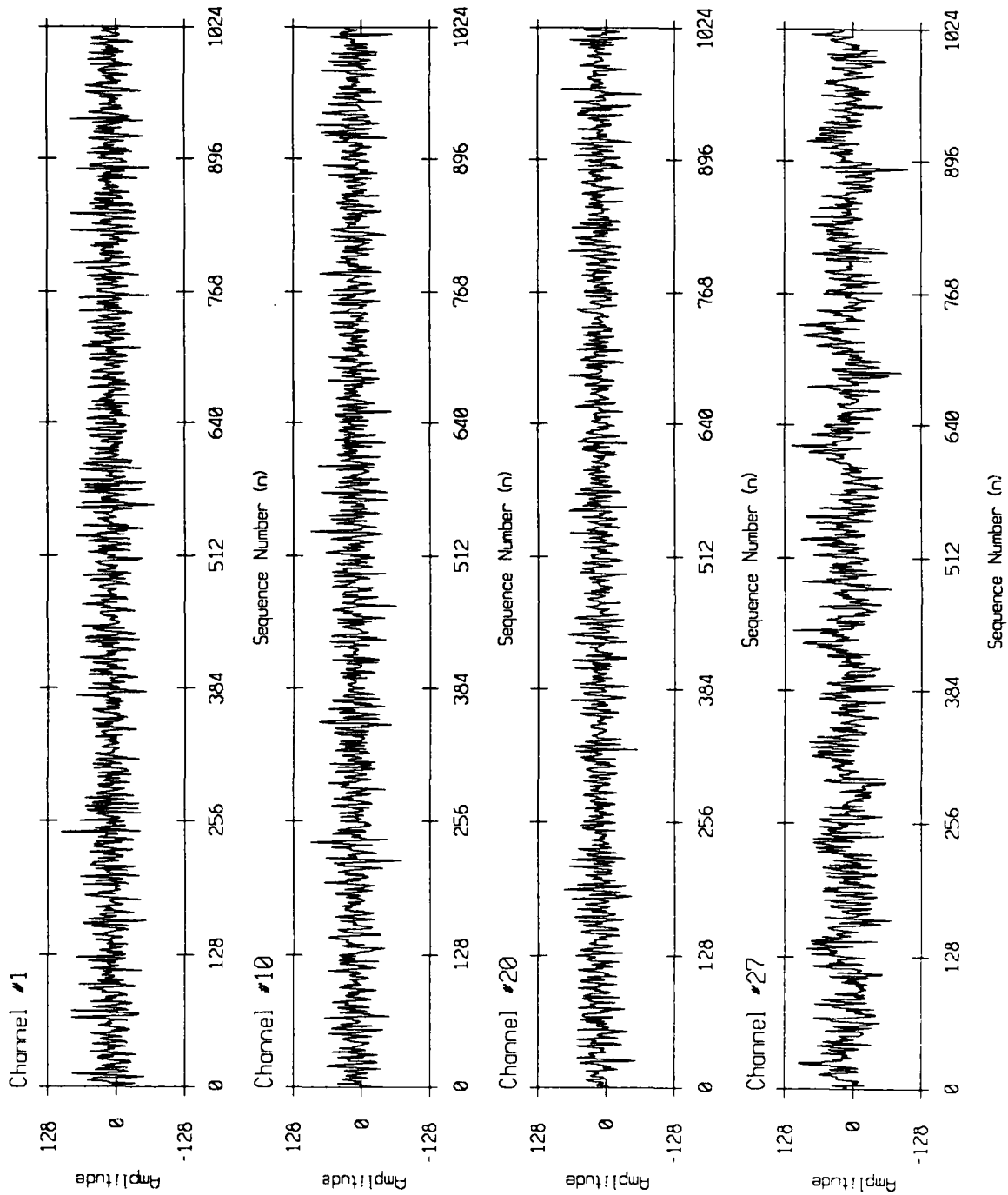
Channel #20

1 13.813934326172

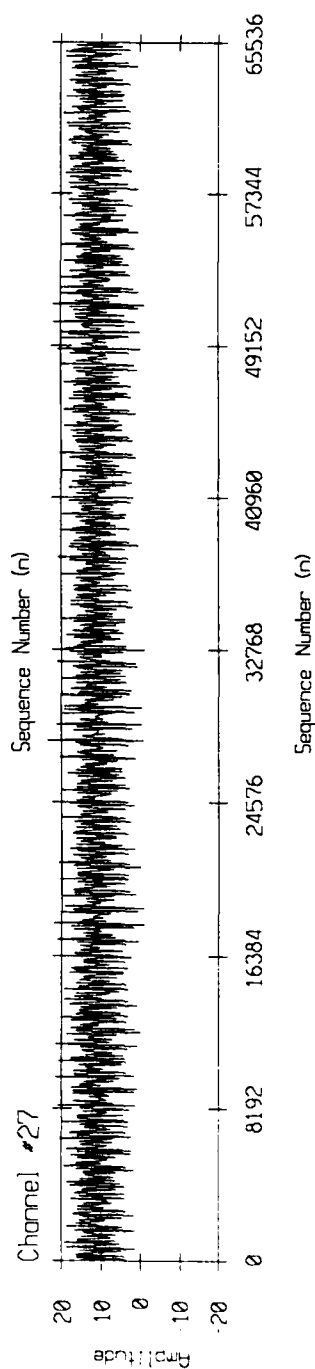
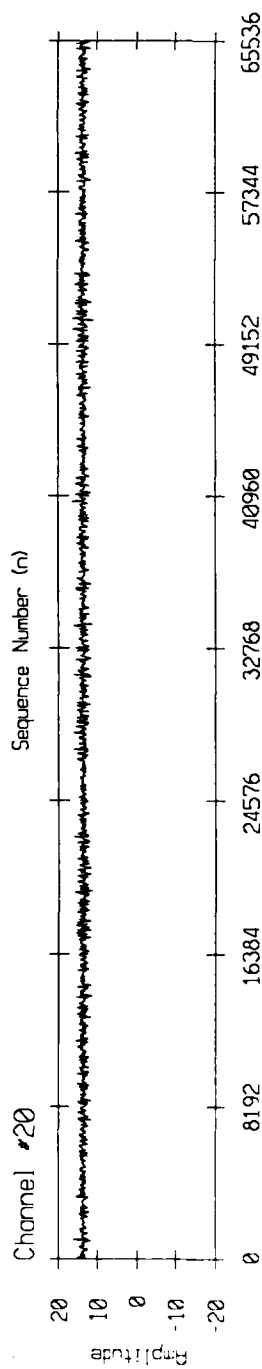
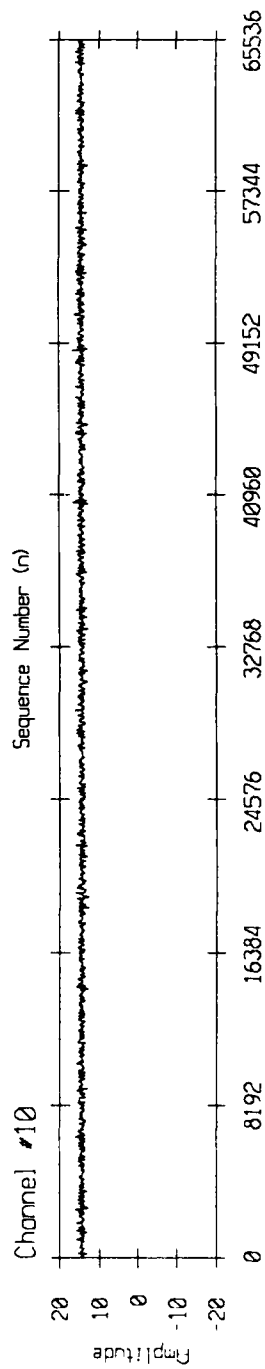
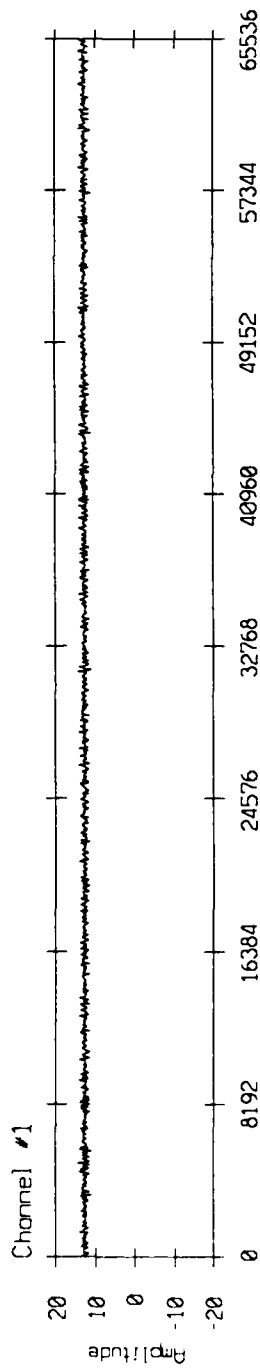
Channel #27

1 11.458801269531

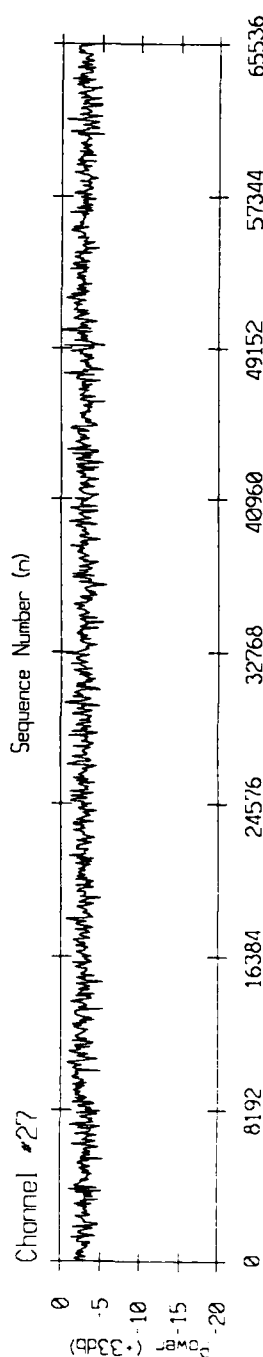
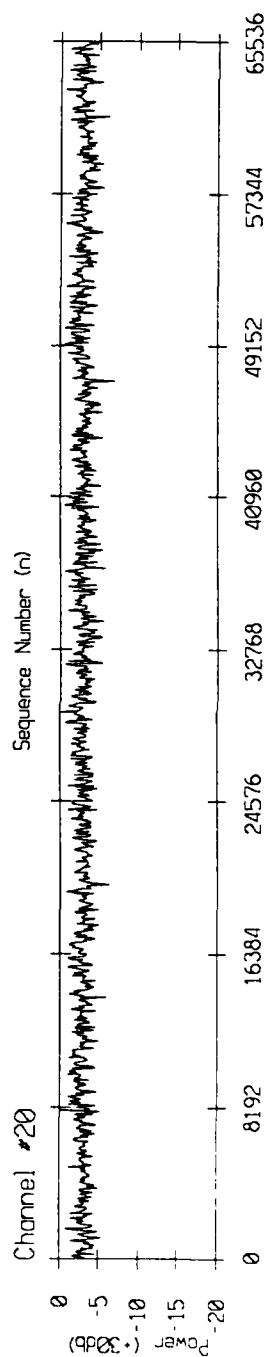
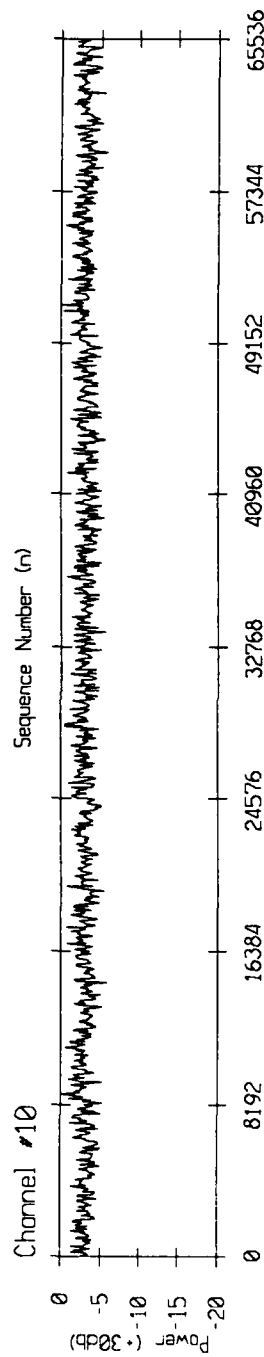
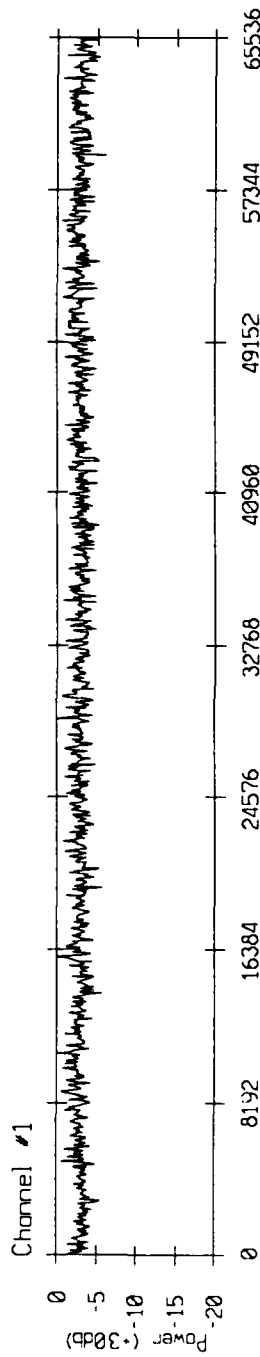
Time Series - 86060.1



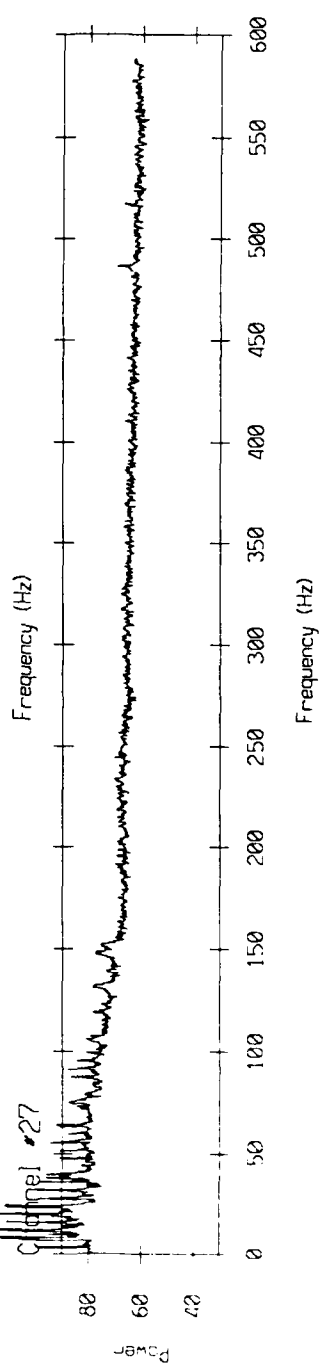
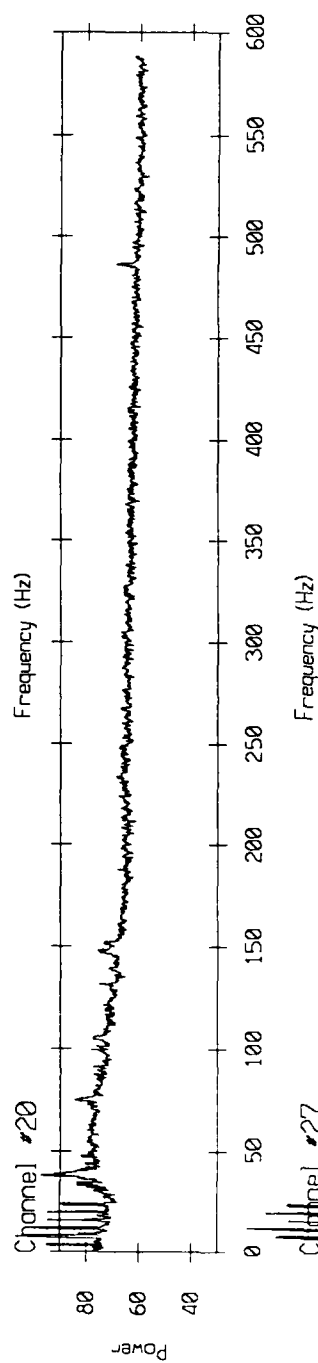
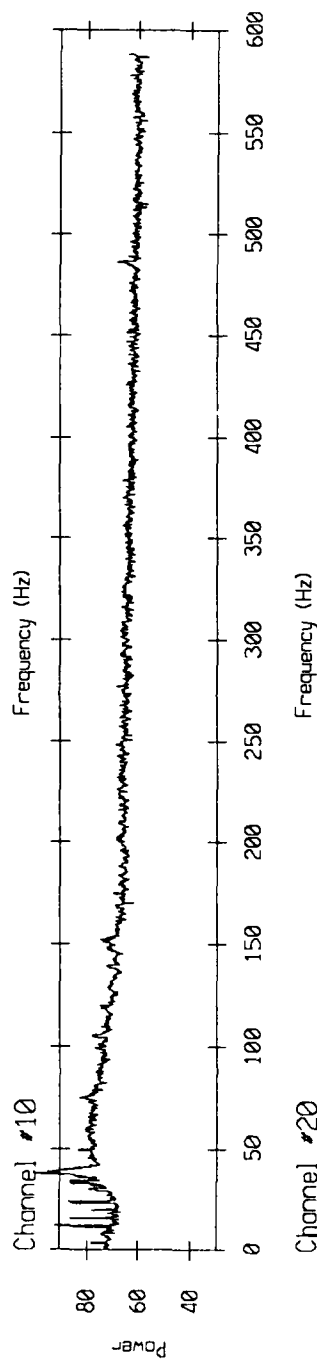
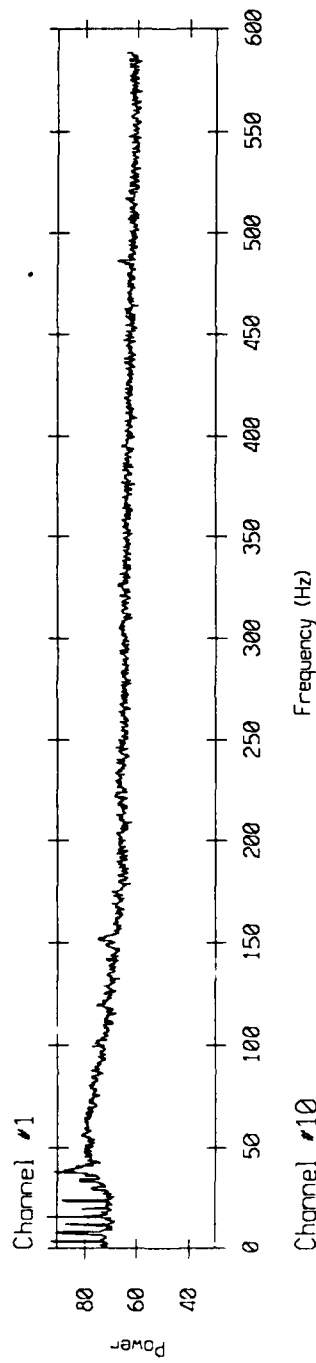
Time Series Mean - 86060.1



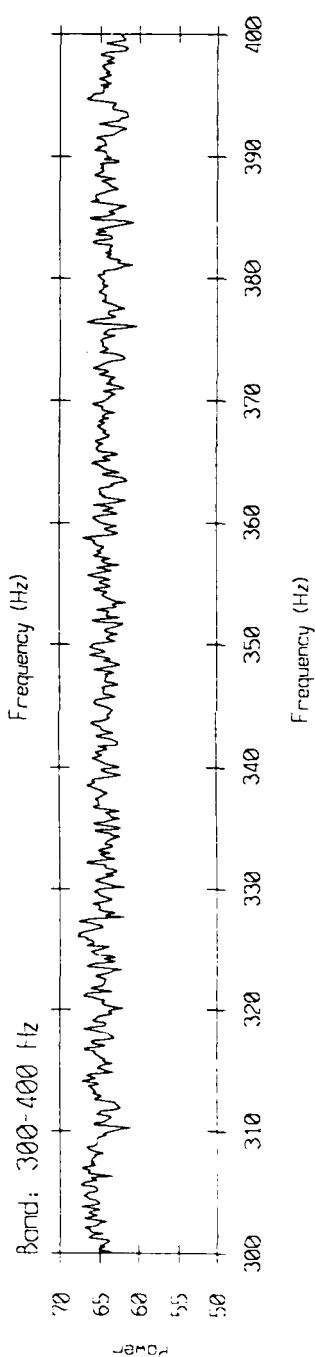
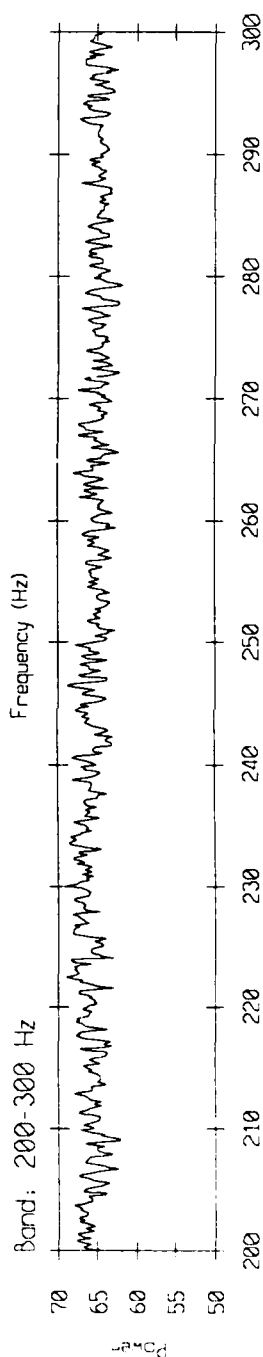
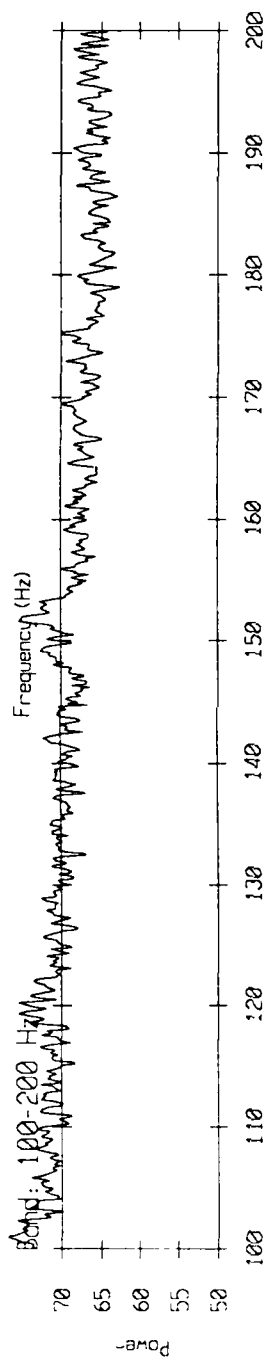
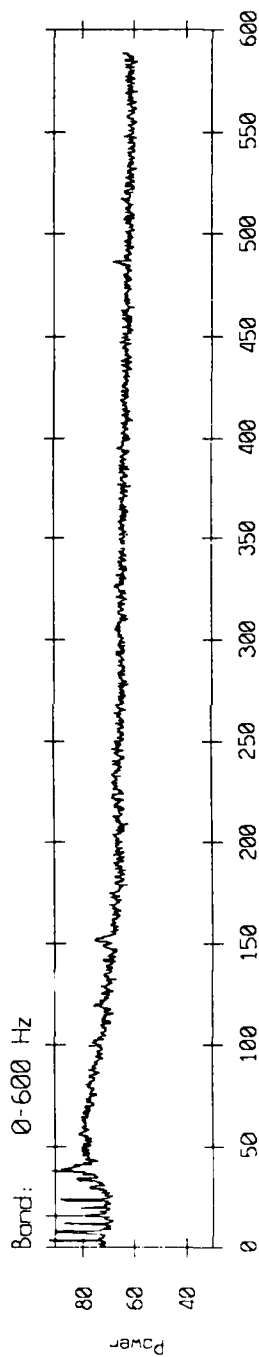
Time Series Power - 86060.1



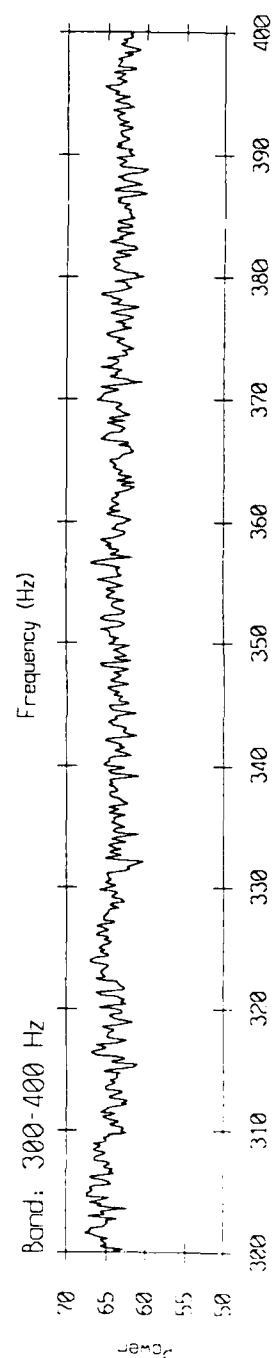
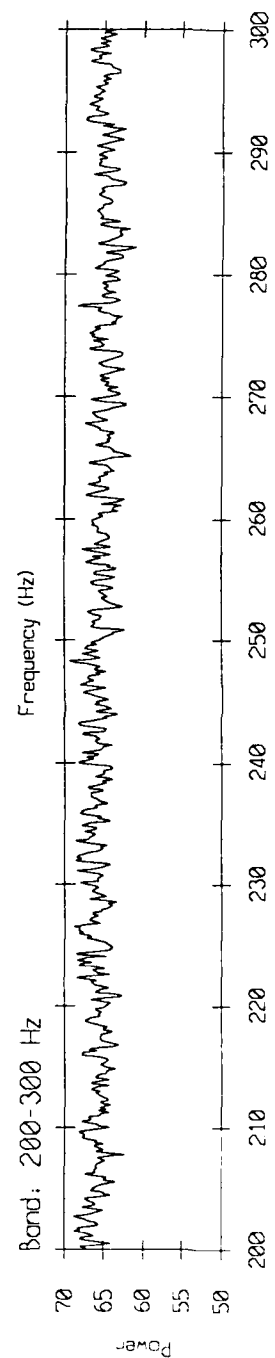
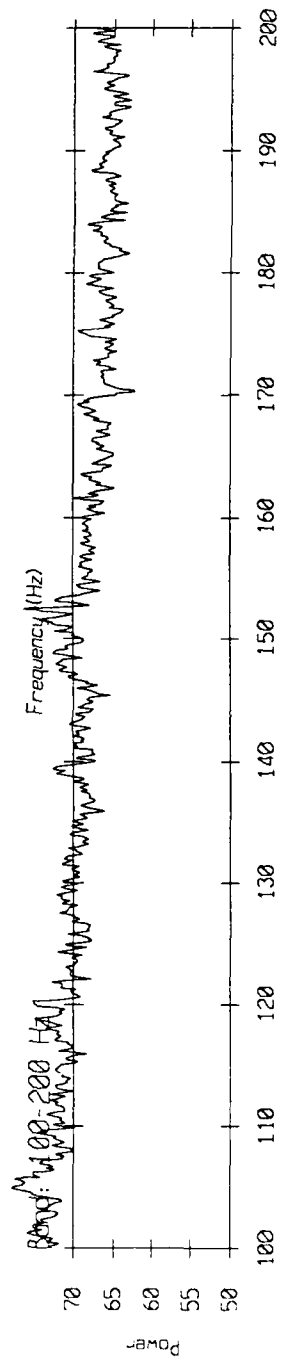
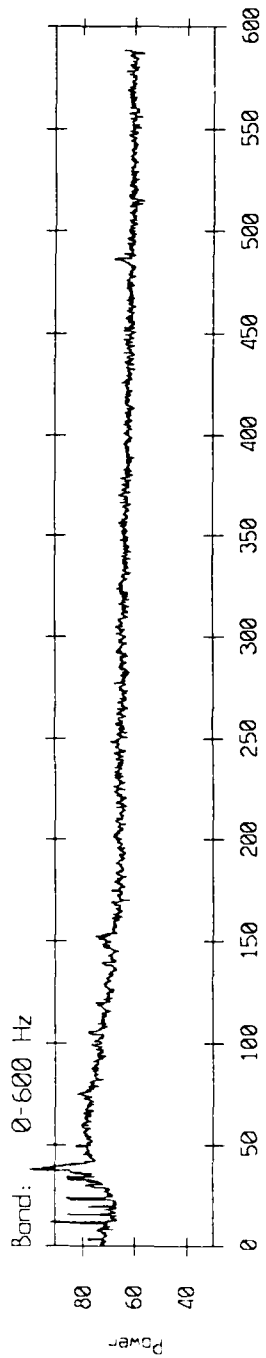
Power Spectrum - 86060.1



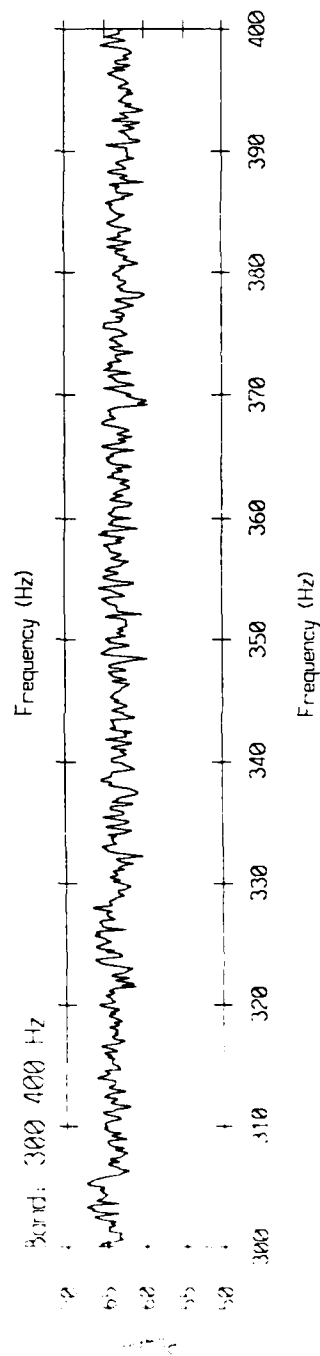
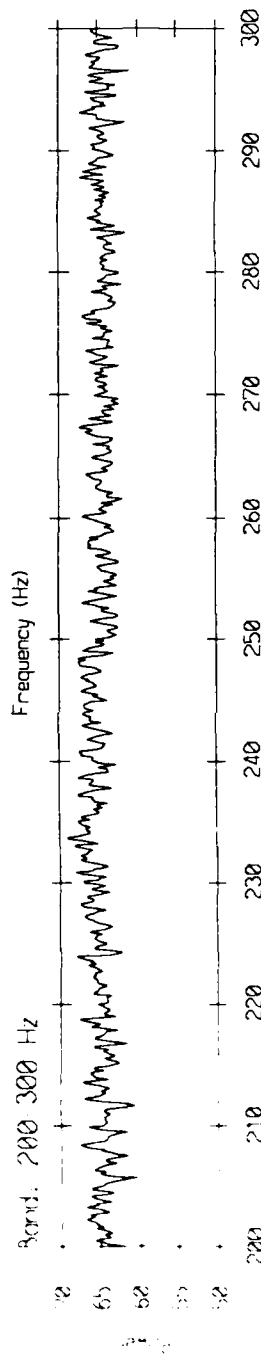
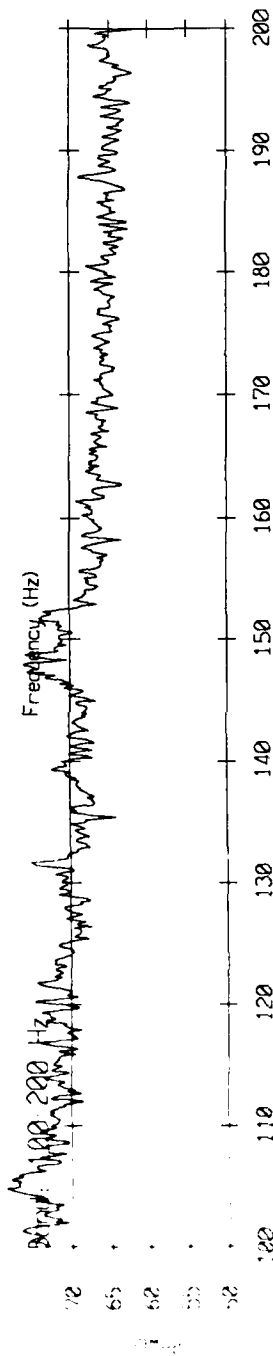
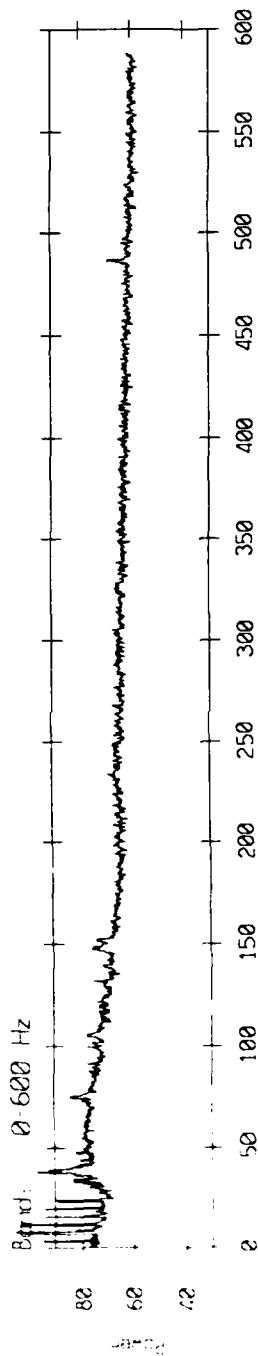
Power Spectrum - 86060.1 Channel #1



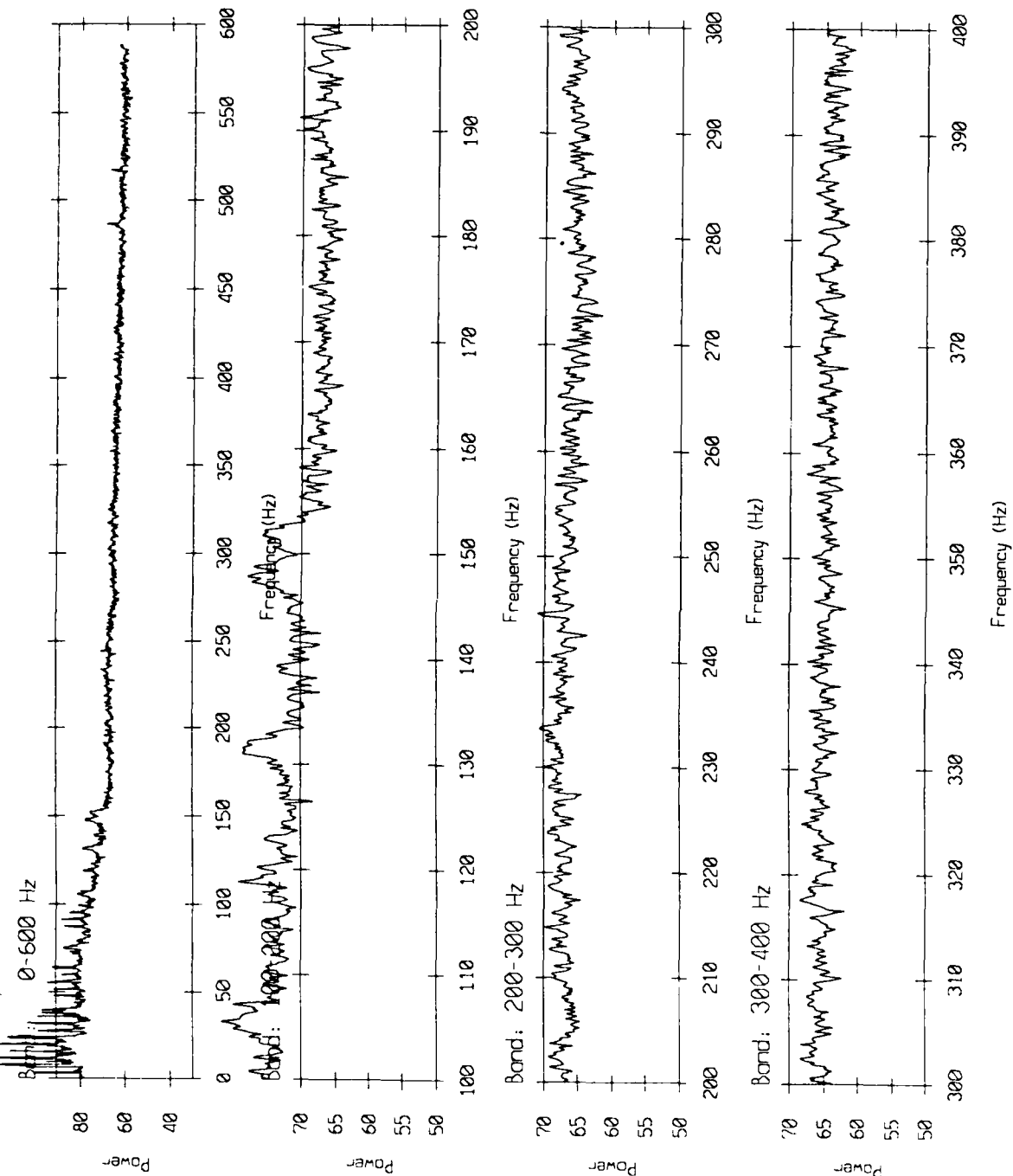
Power Spectrum - 86060.1 Channel #10



Power Spectrum - 86060.1 Channel #20



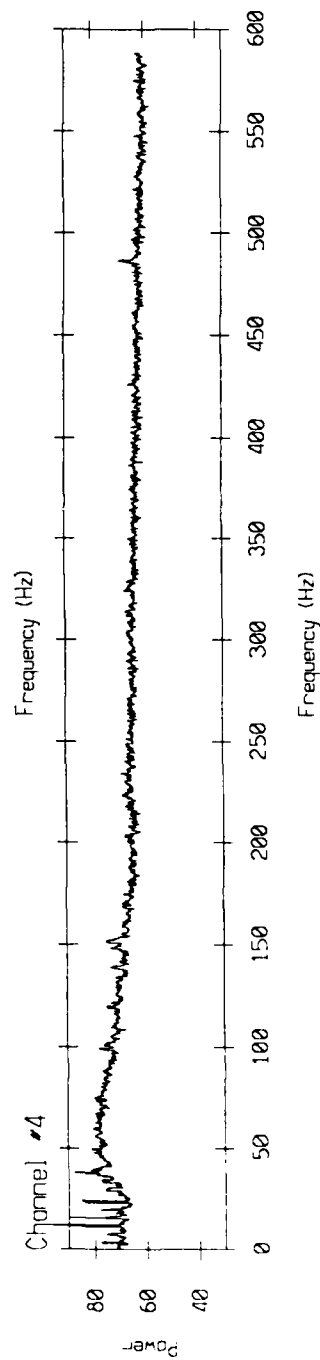
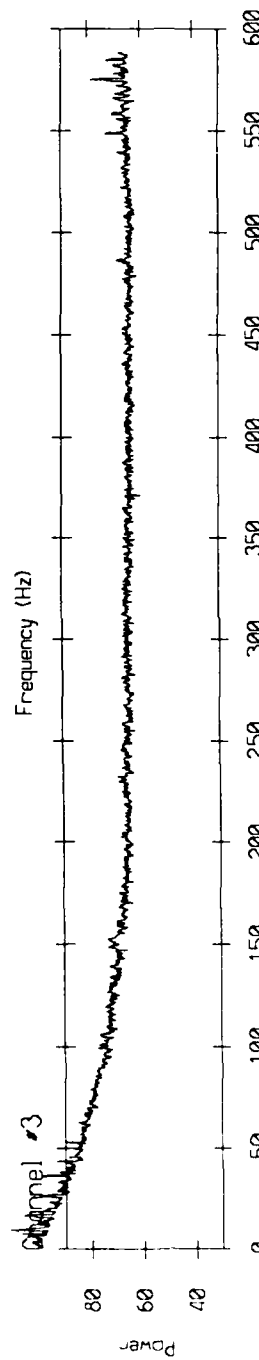
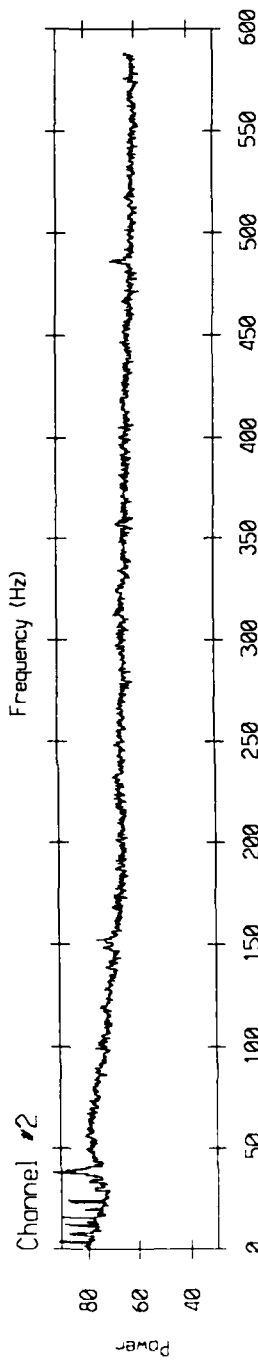
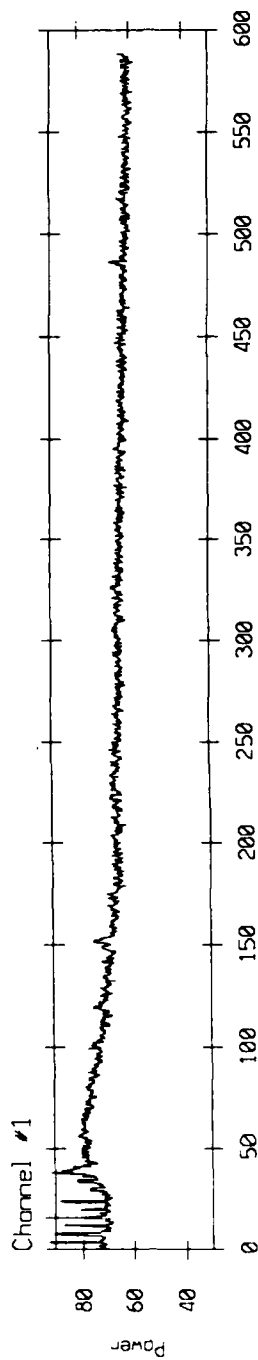
Power Spectrum - 86060.1 Channel #27



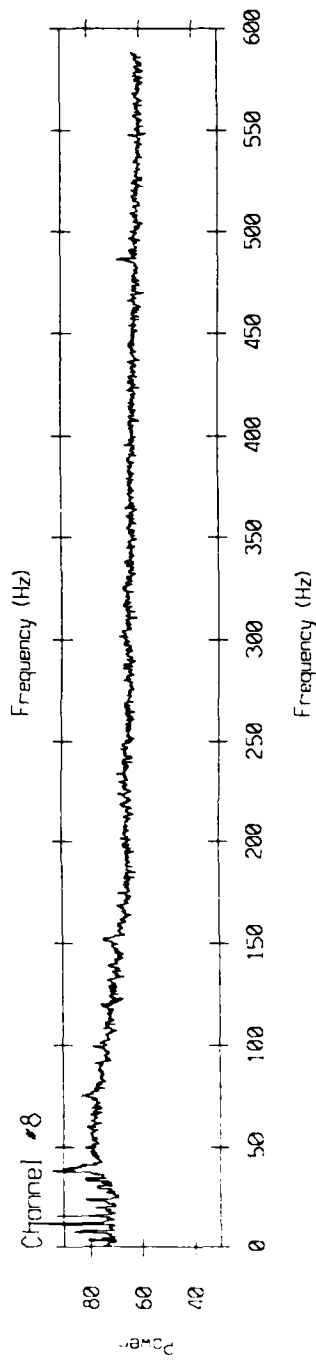
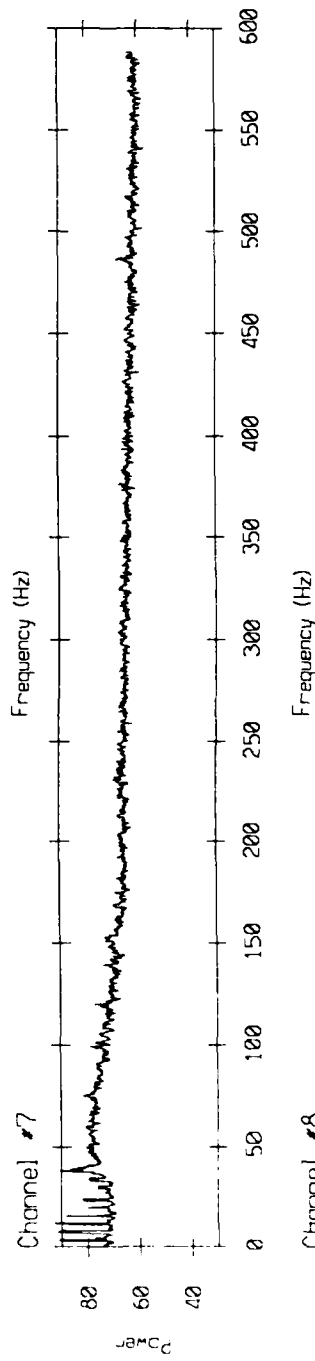
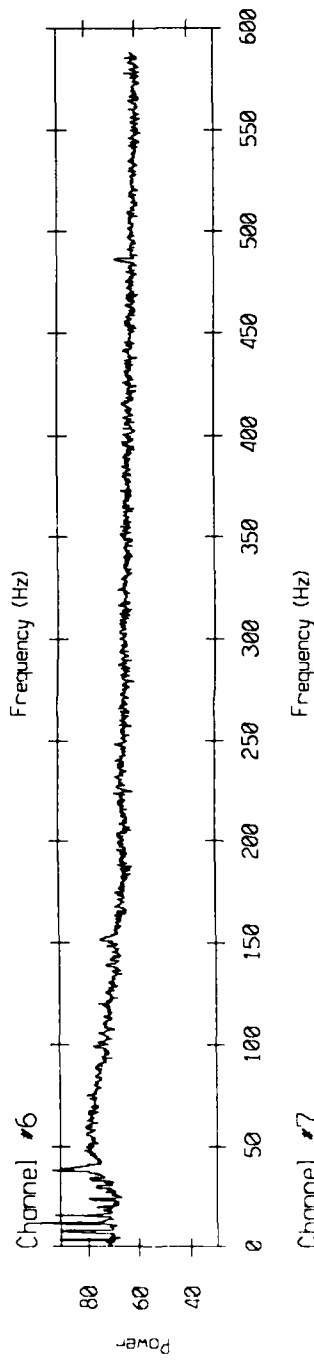
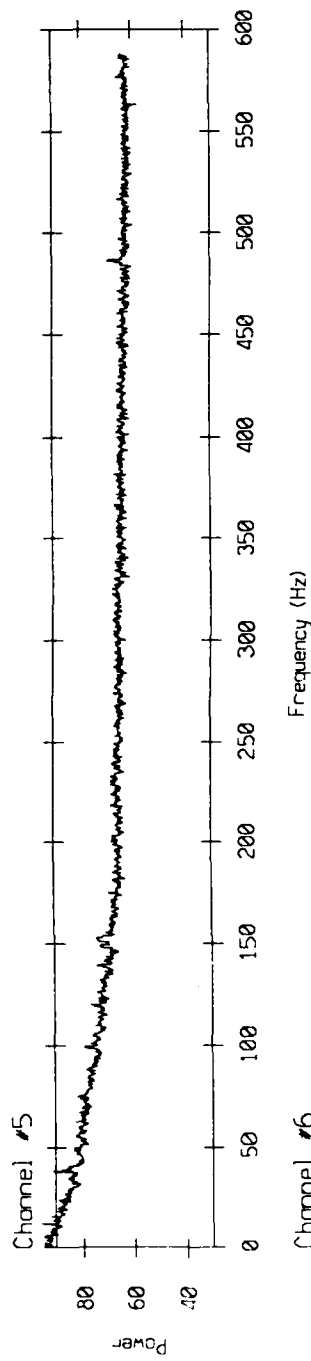
III. Power Spectra.

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1 12.944747924805
Channel #2
1 11.466491699219
Channel #3
1 11.199615478516
Channel #4
1 10.926193237305
Channel #5
1 12.488723754883
Channel #6
1 9.8551940917969
Channel #7
1 14.709869384766
Channel #8
1 14.914657592773
Channel #9
1 6.4771270751953
Channel #10
1 14.547775268555
Channel #11
1 10.473587036133
Channel #12
1 14.125381469727
Channel #13
1 10.947708129883
Channel #14
1 -62.291854858398
Channel #15
1 12.481811523438
Channel #16
1 8.7545318603516
Channel #17
1 13.131912231445
Channel #18
1 12.899734497070
Channel #19
1 -51.949523925781
Channel #20
1 13.813934326172
Channel #21
1 13.517852783203
Channel #22
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Channel #27
1 11.458801269531

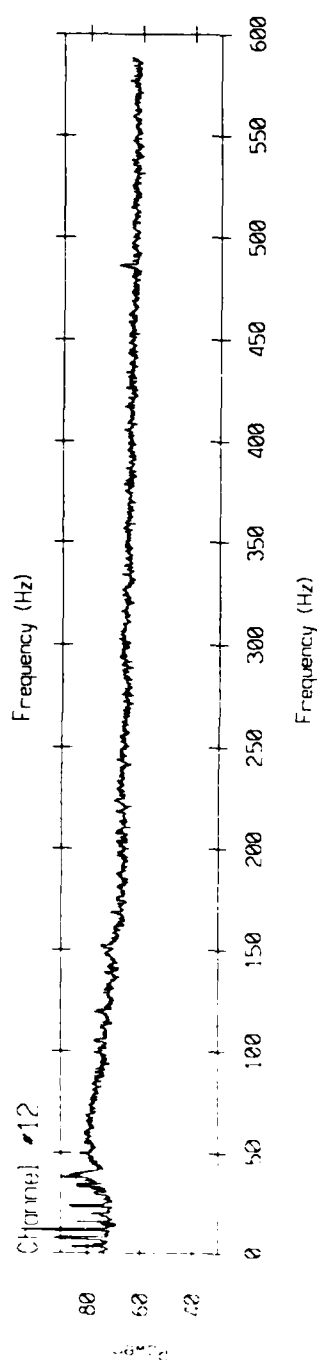
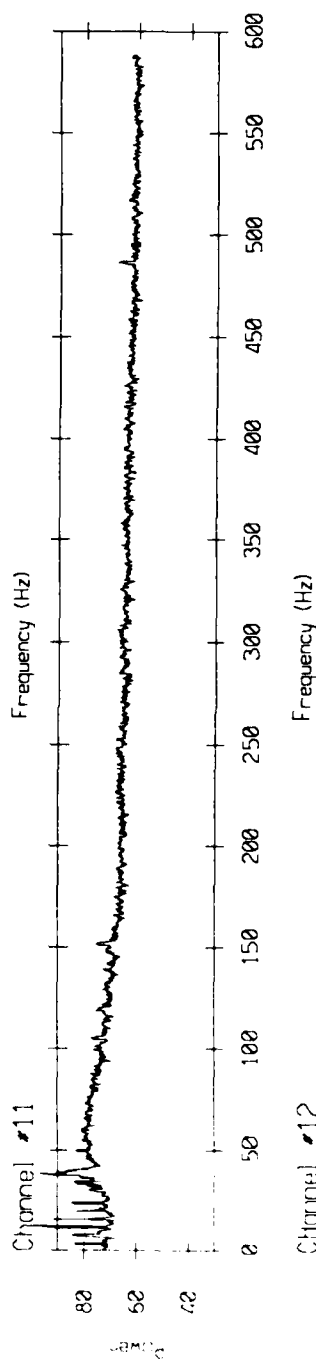
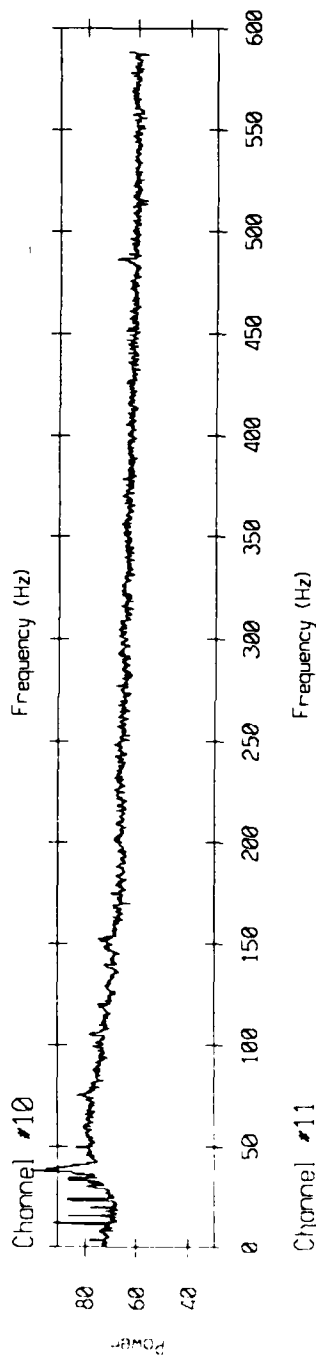
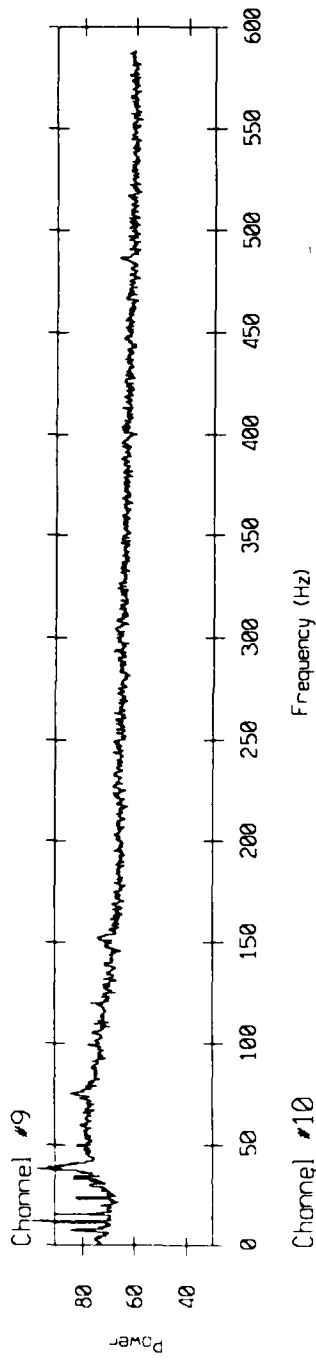
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Power Spectrum - 86060.1

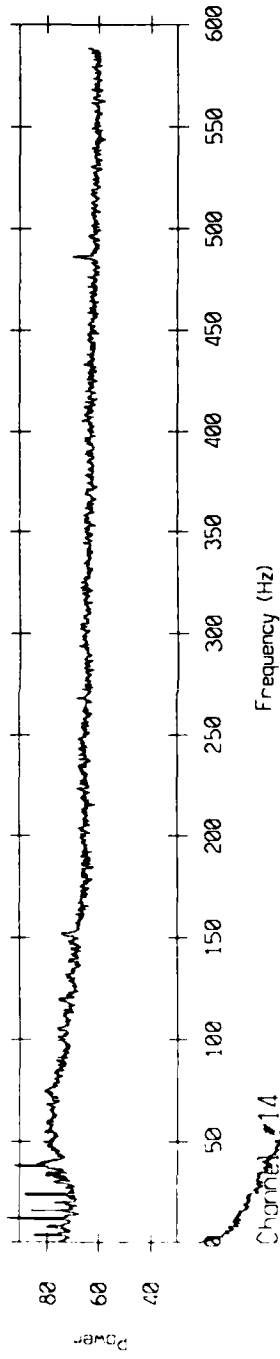


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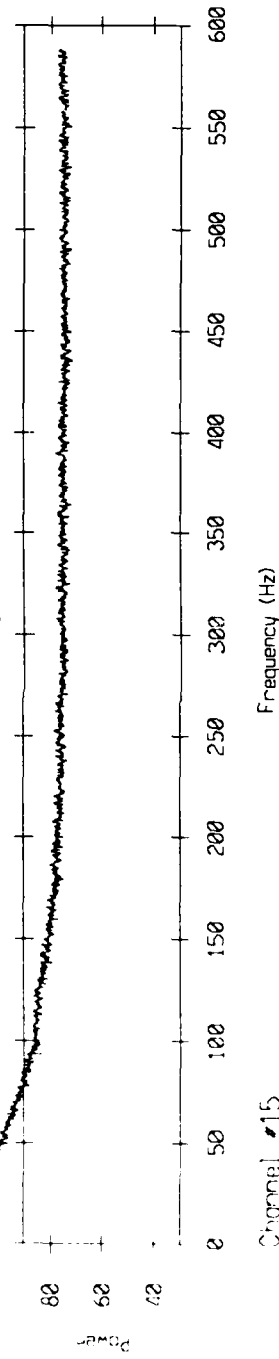


Power Spectrum - 86060.1

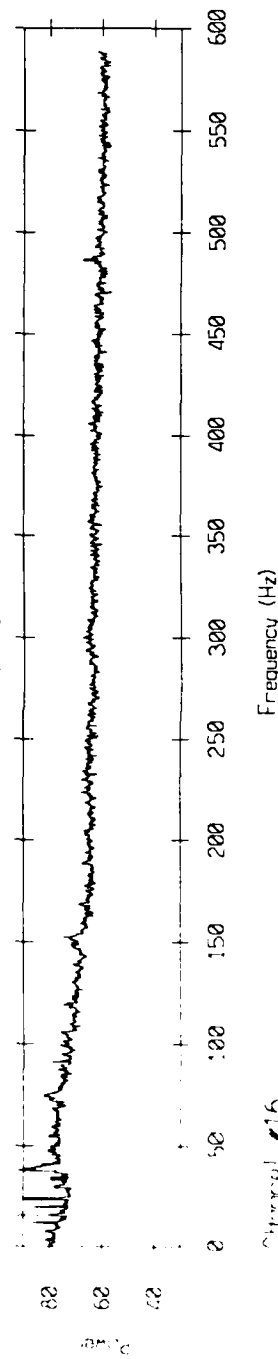
Channel #13



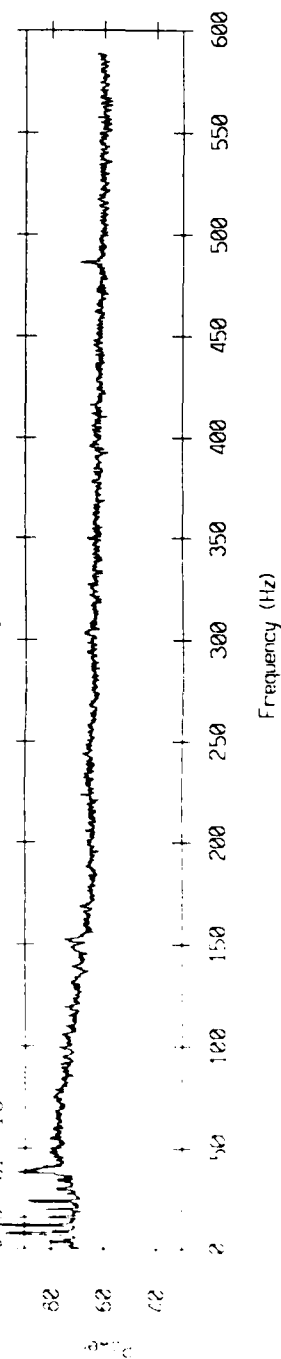
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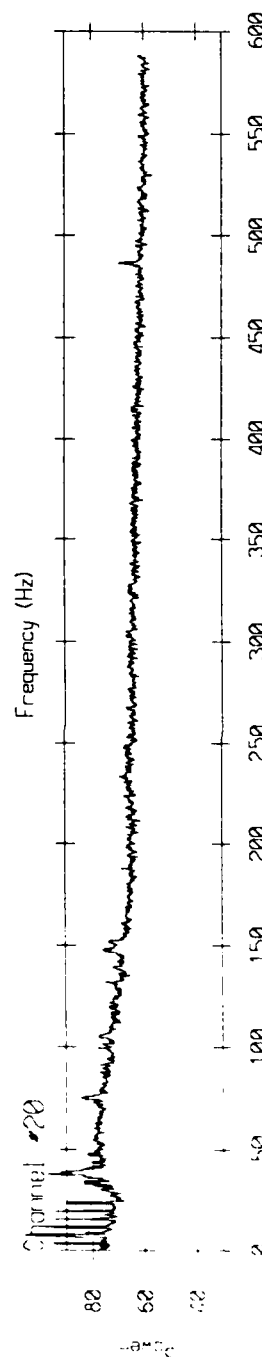
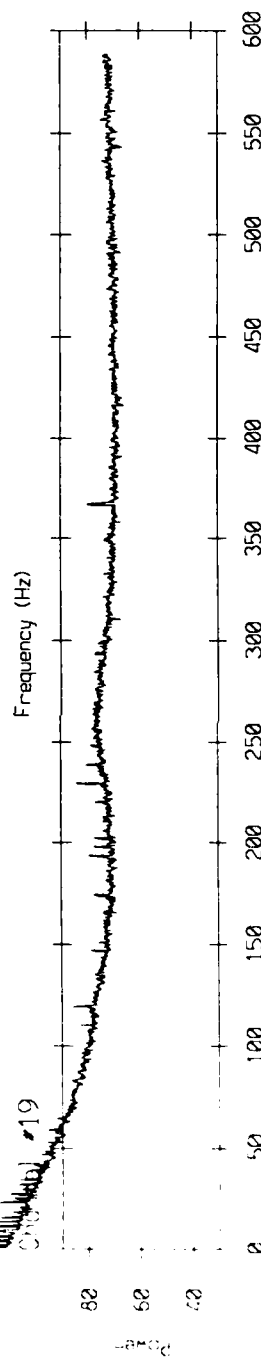
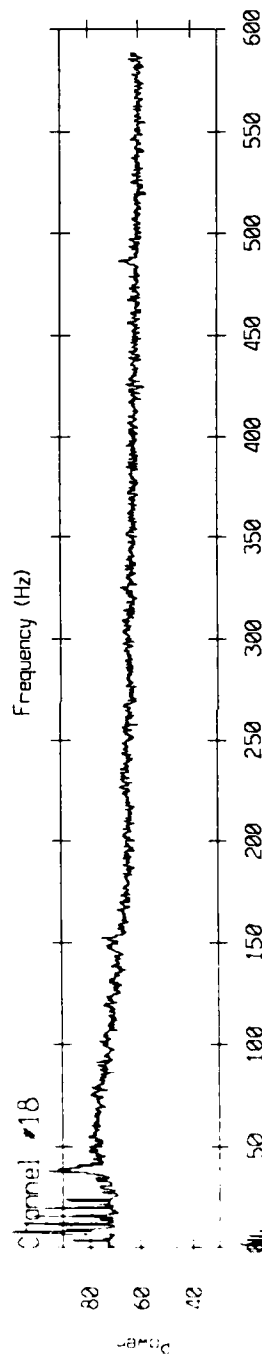
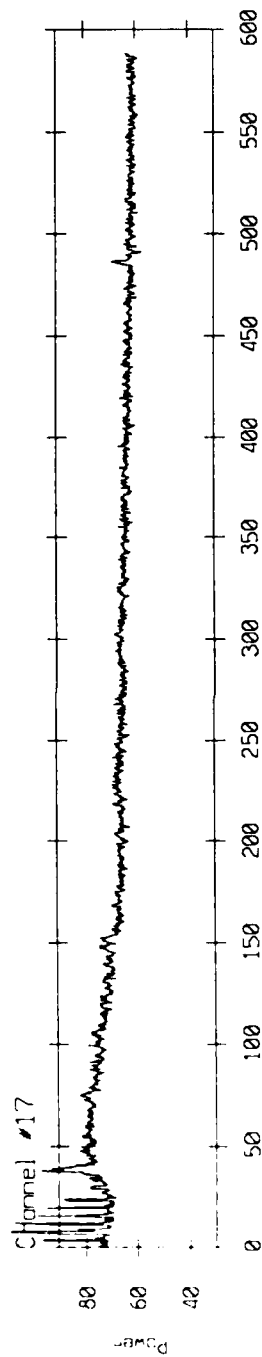
Channel #15



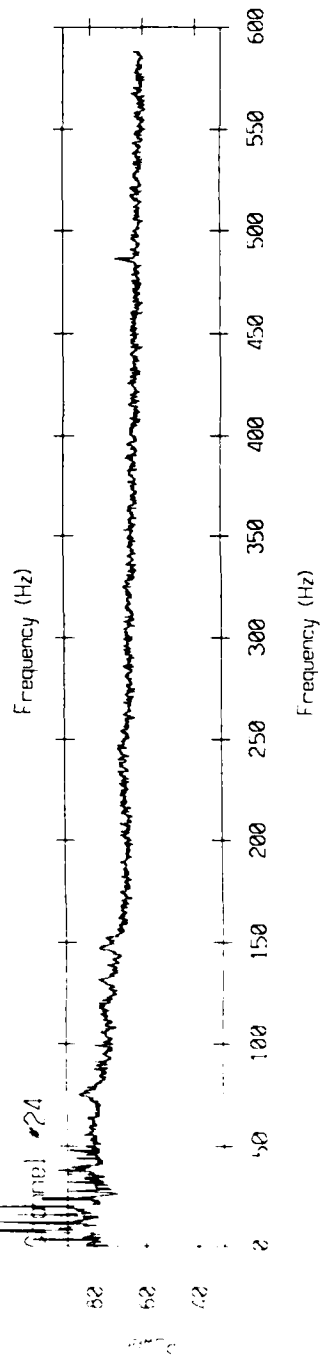
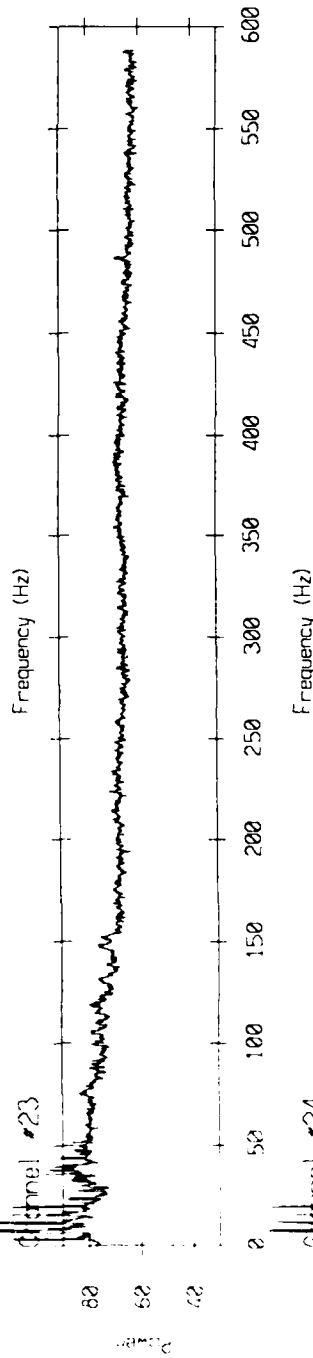
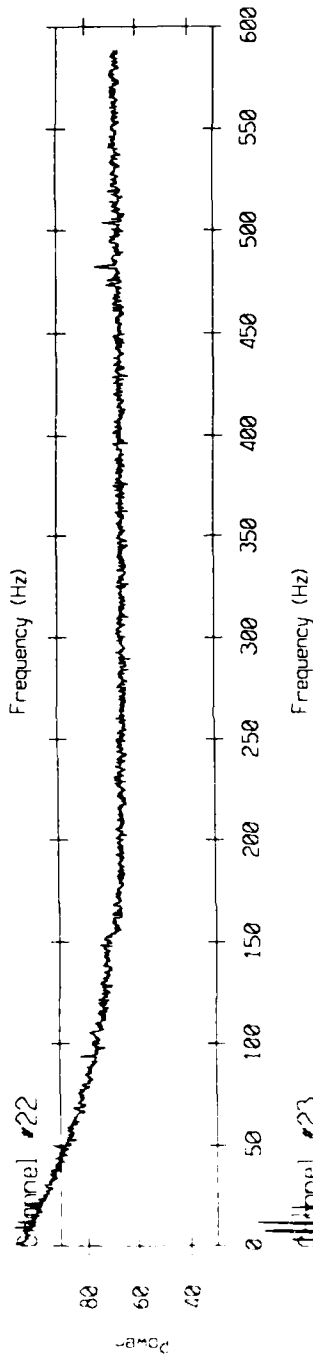
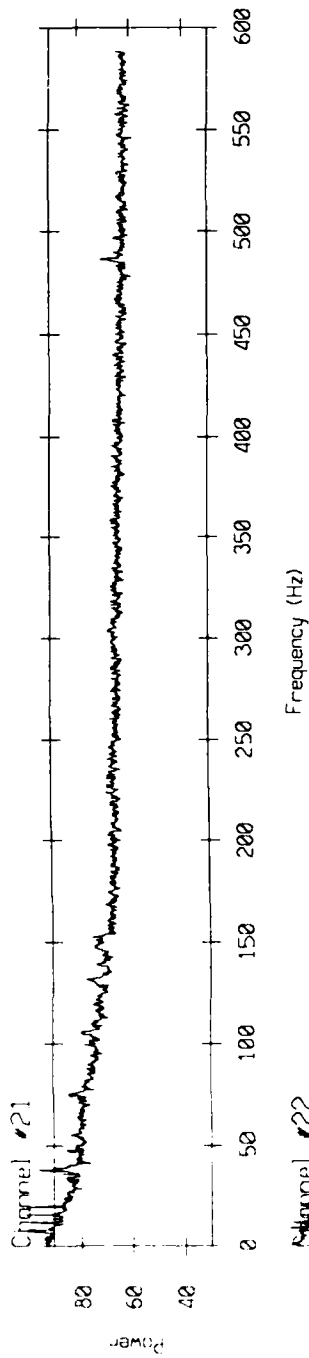
Channel #16



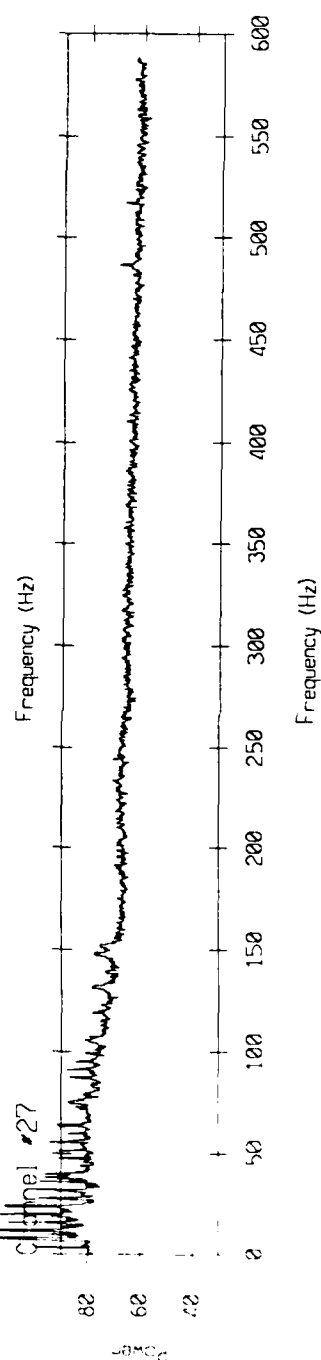
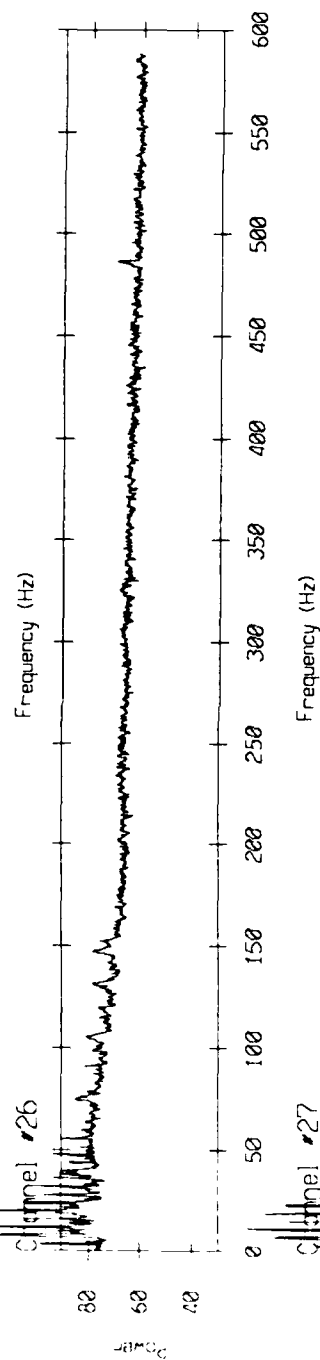
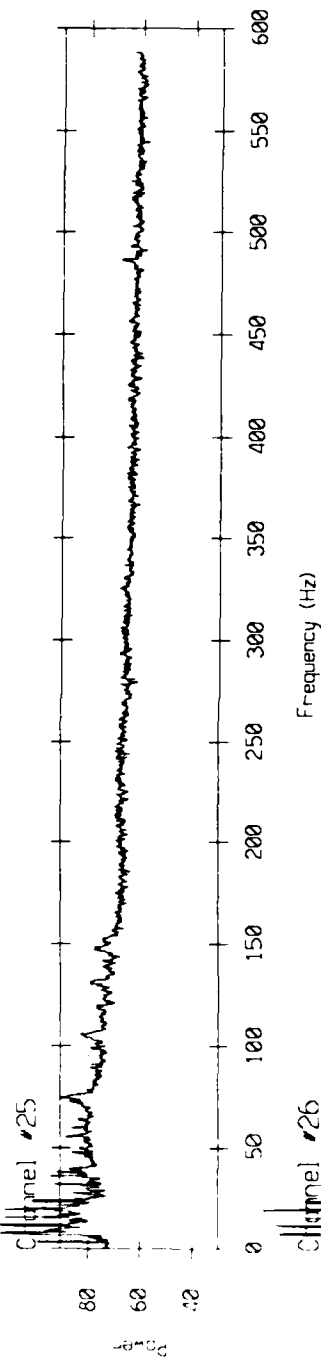
Power Spectrum - 86060.1



Power Spectrum - 86060.1

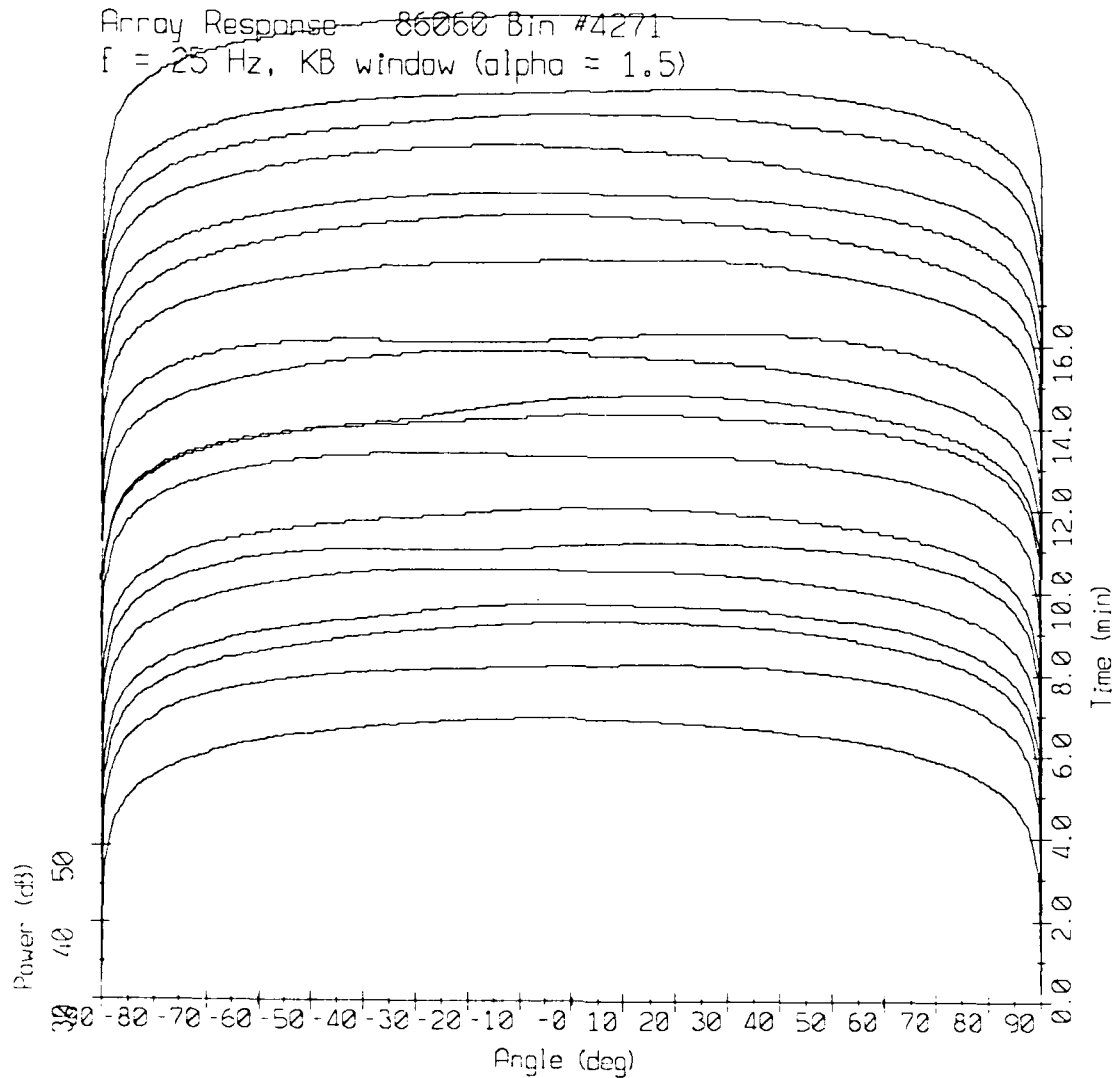


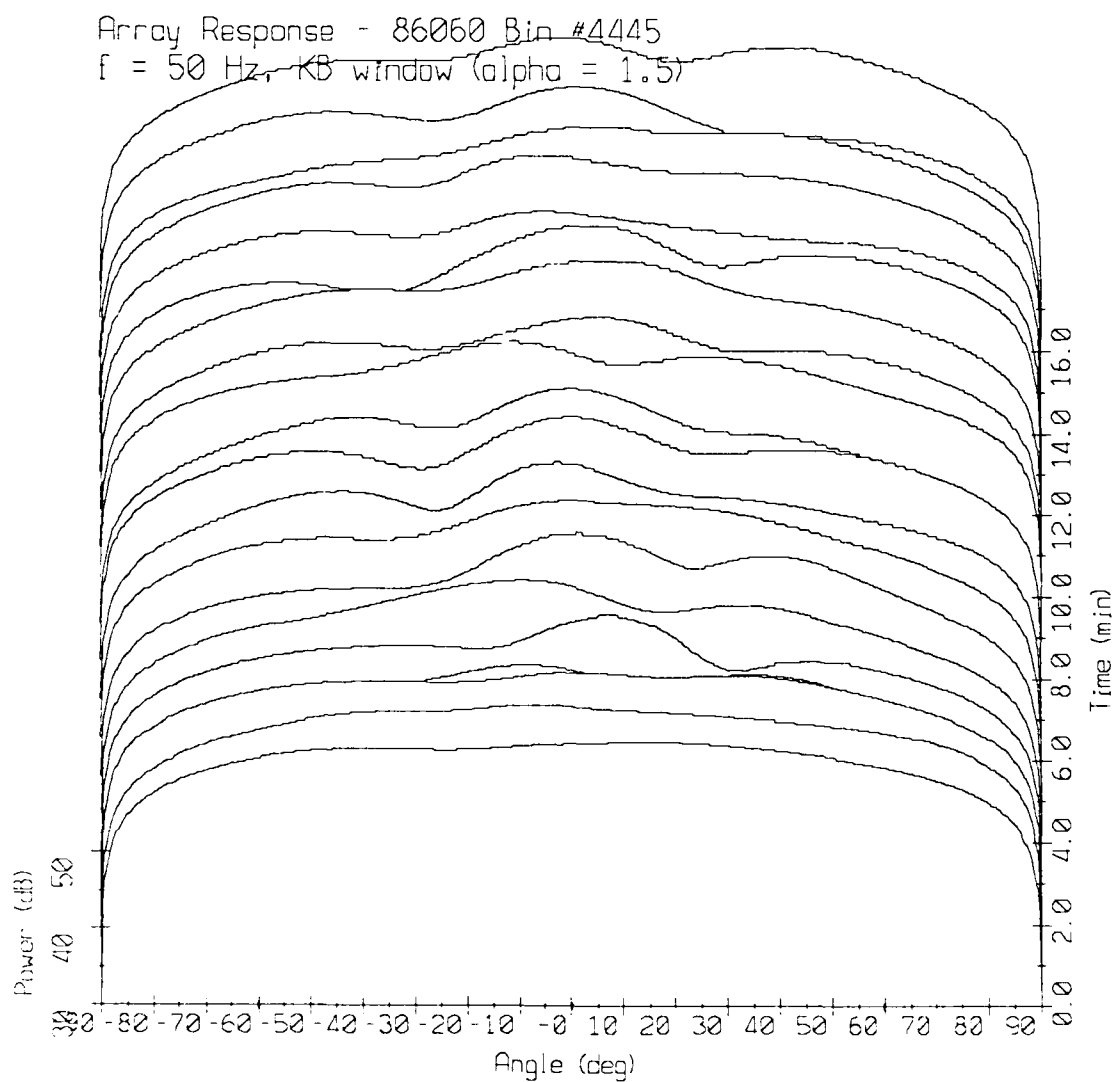
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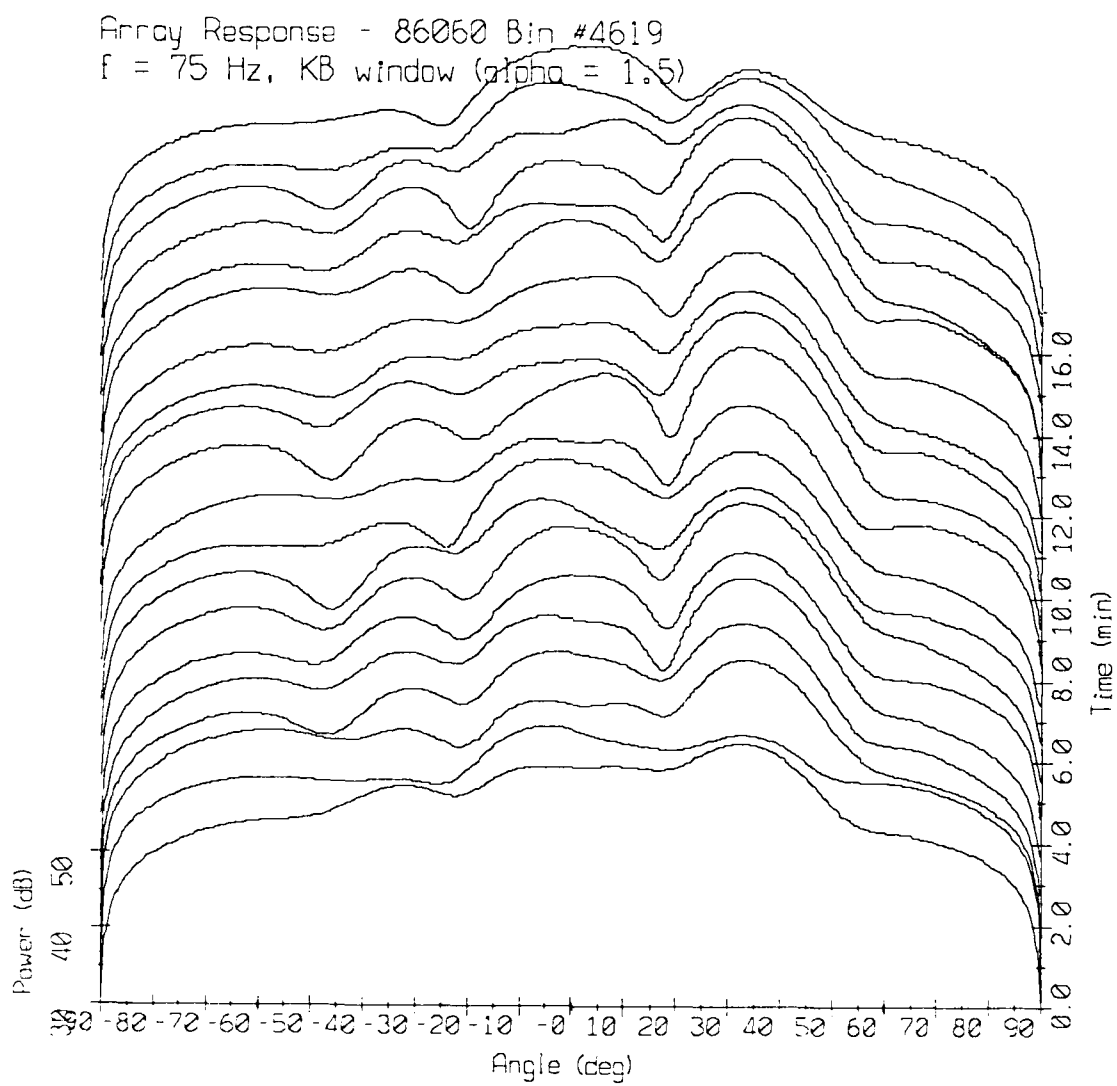


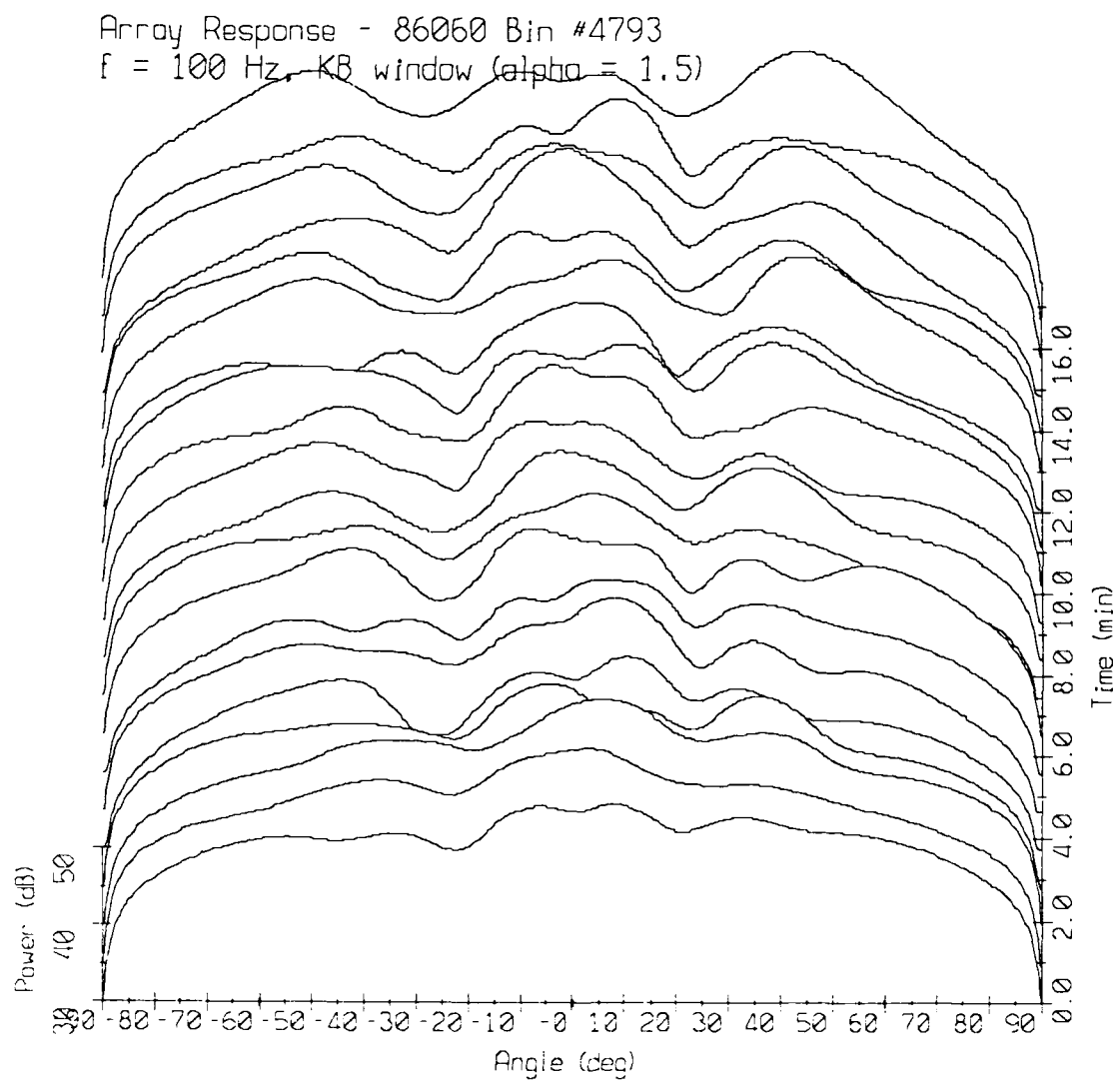
IV. Array Response: Waterfall, KB Window.

Array Response 86060 Bin #4271
f = 25 Hz, KB window (alpha = 1.5)

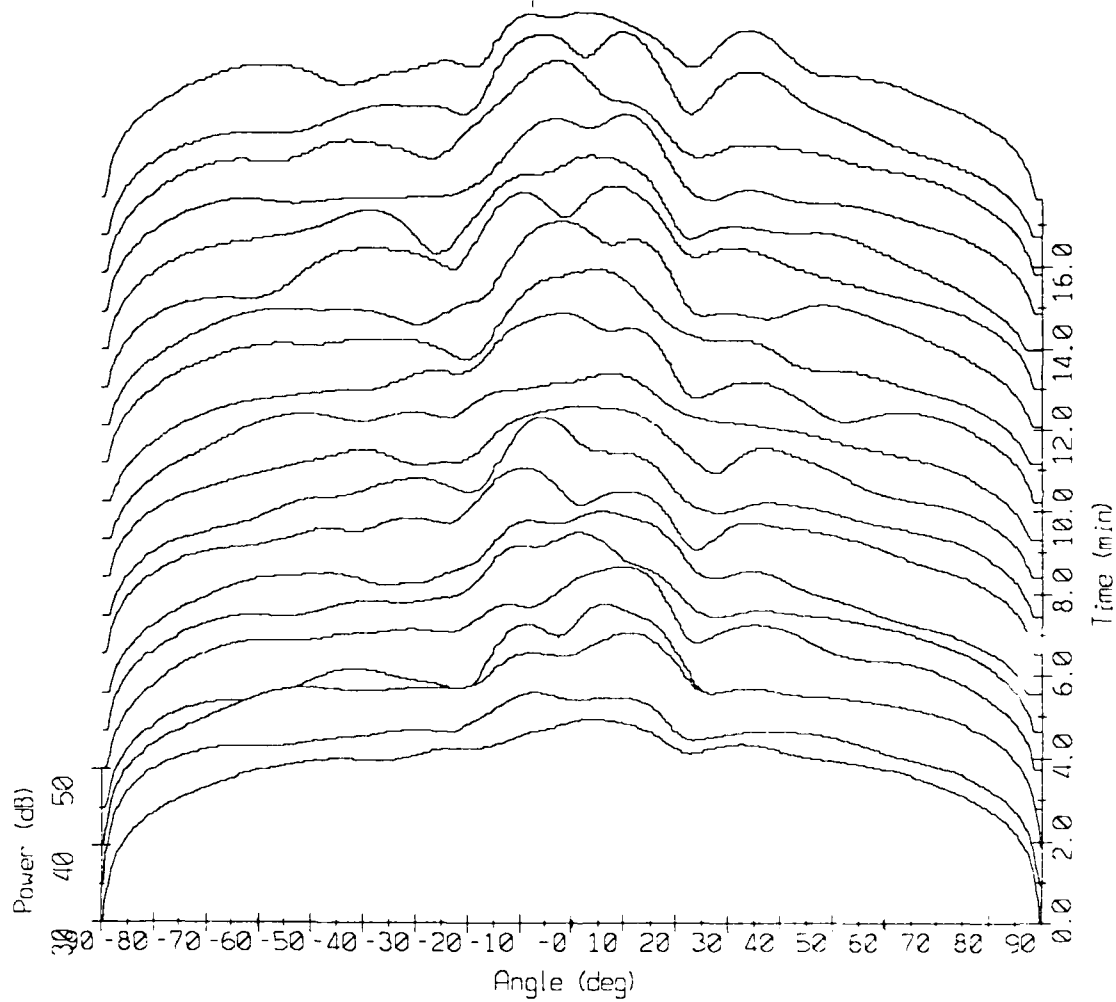




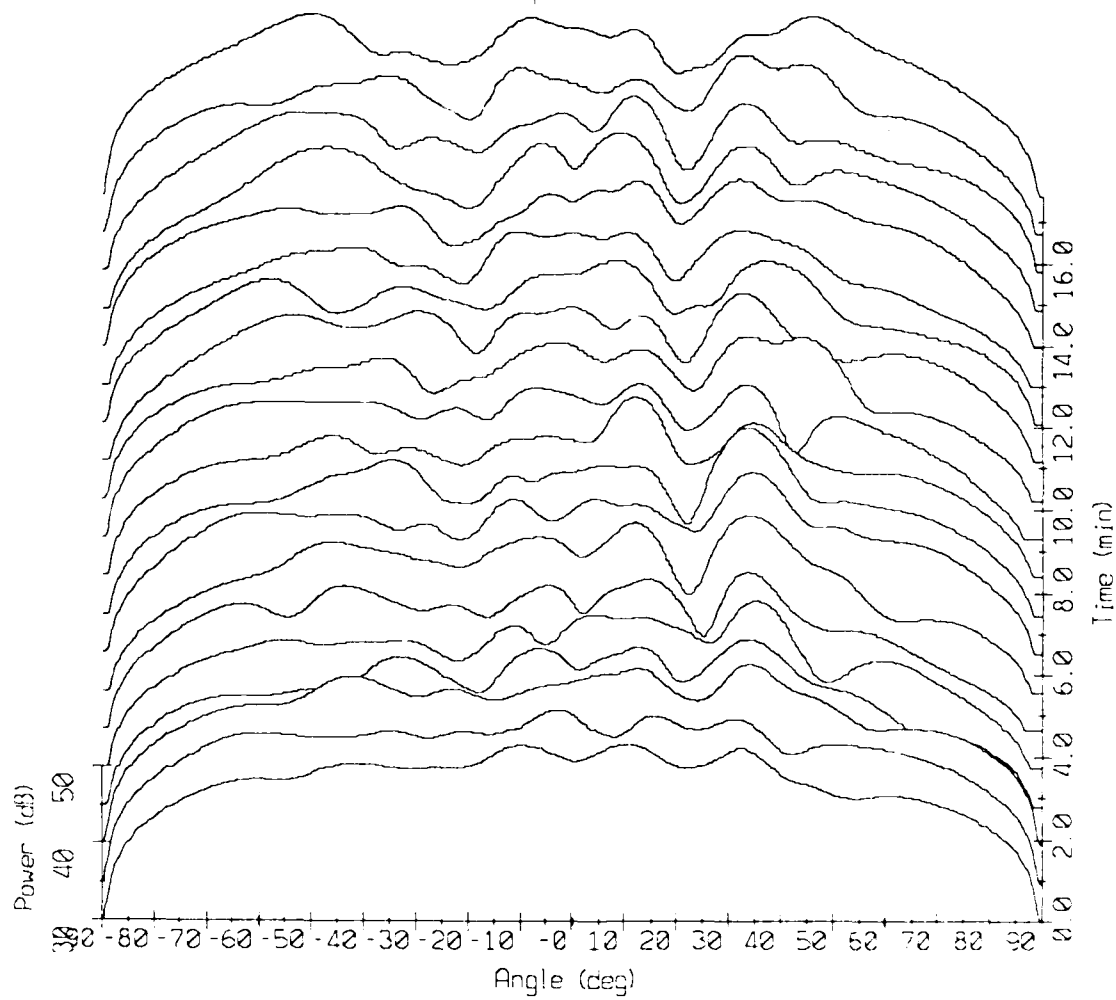




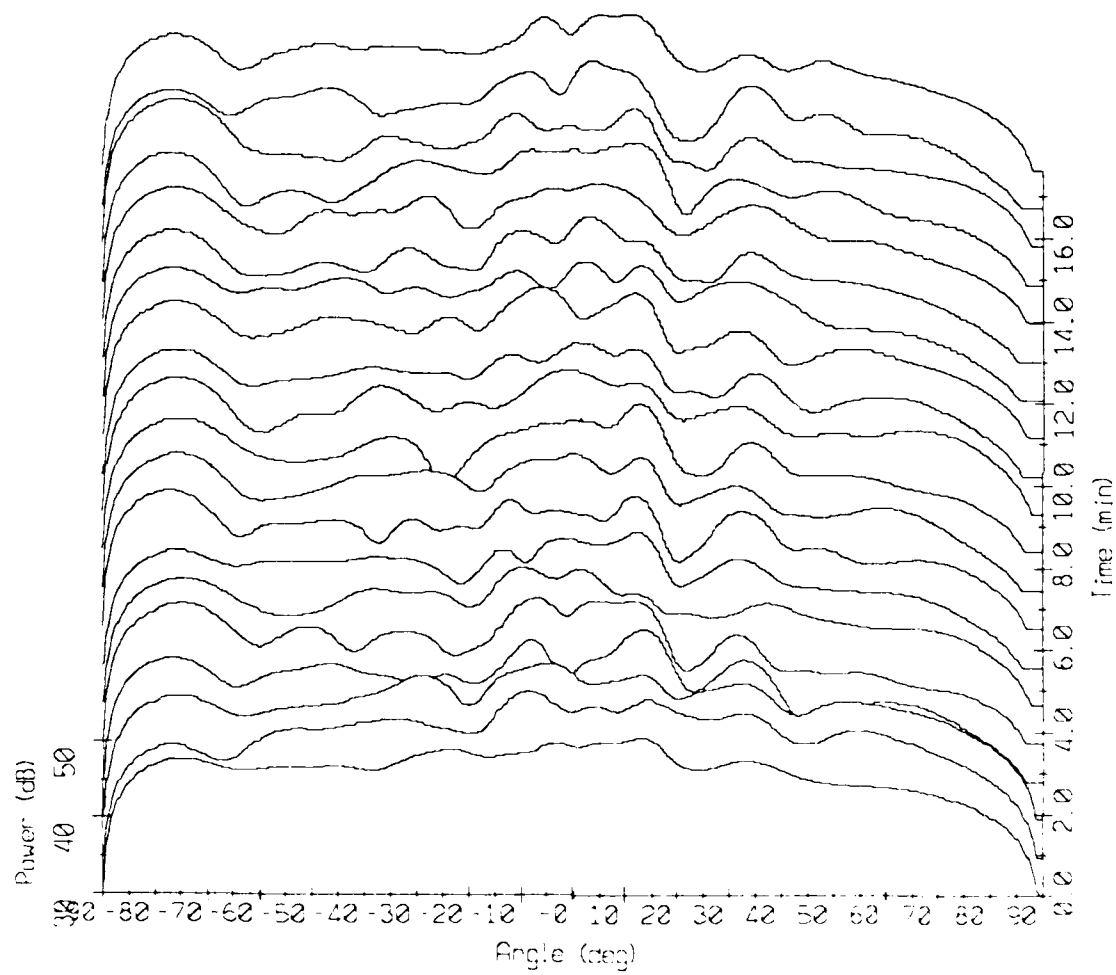
Array Response - 86060 Bin #4967
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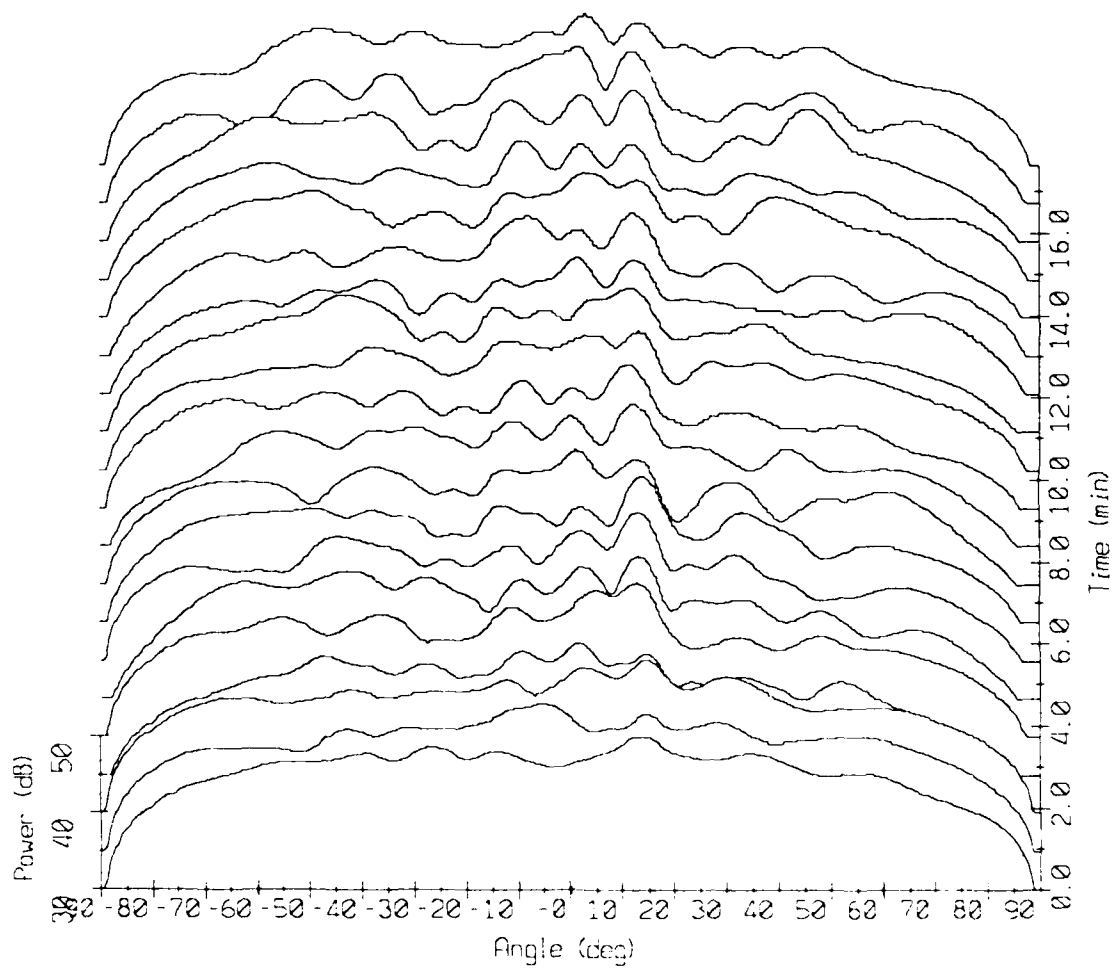
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 $f = 150$ Hz, KB window ($\alpha = 1.5$)



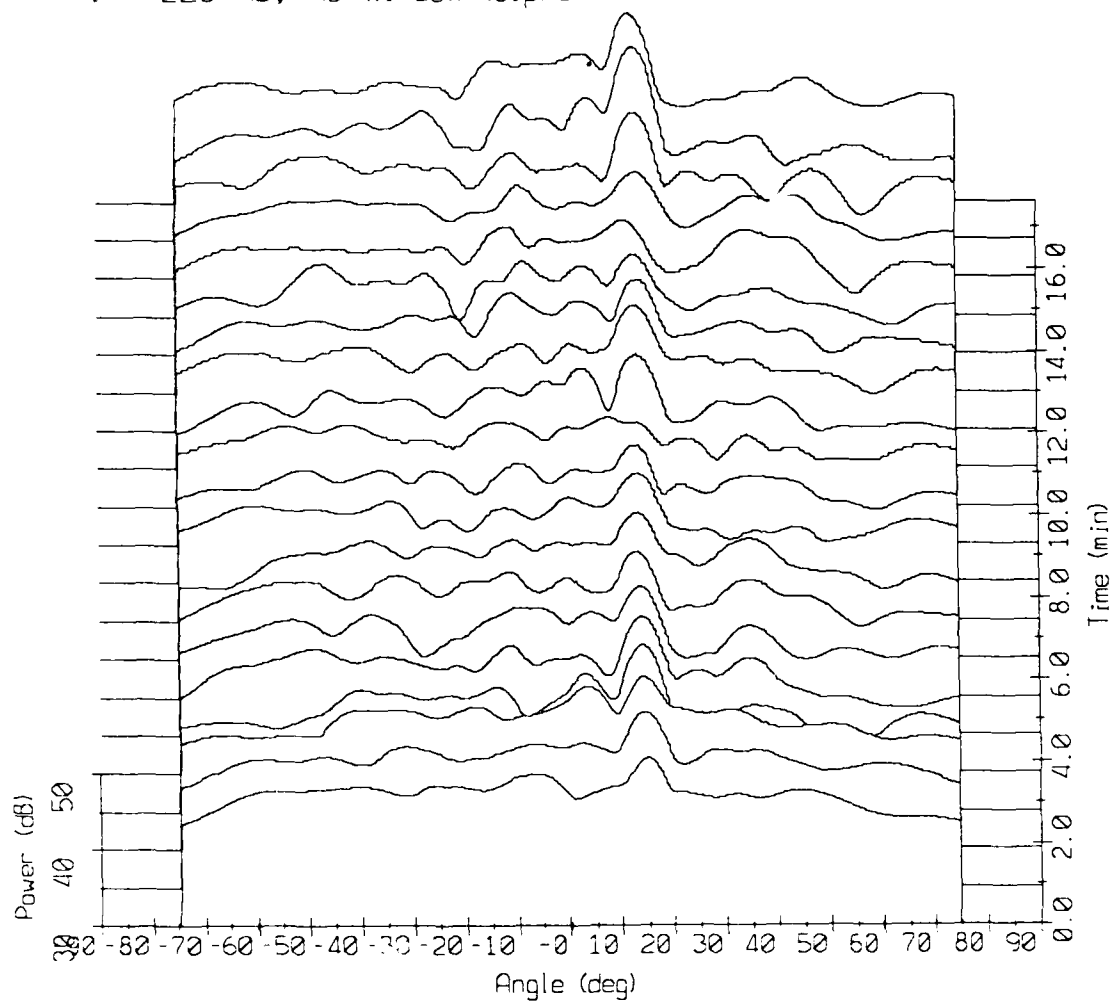
Array Response - 86060 Bin #5316
 $f = 175$ Hz, KB window ($\alpha = 1.5$)



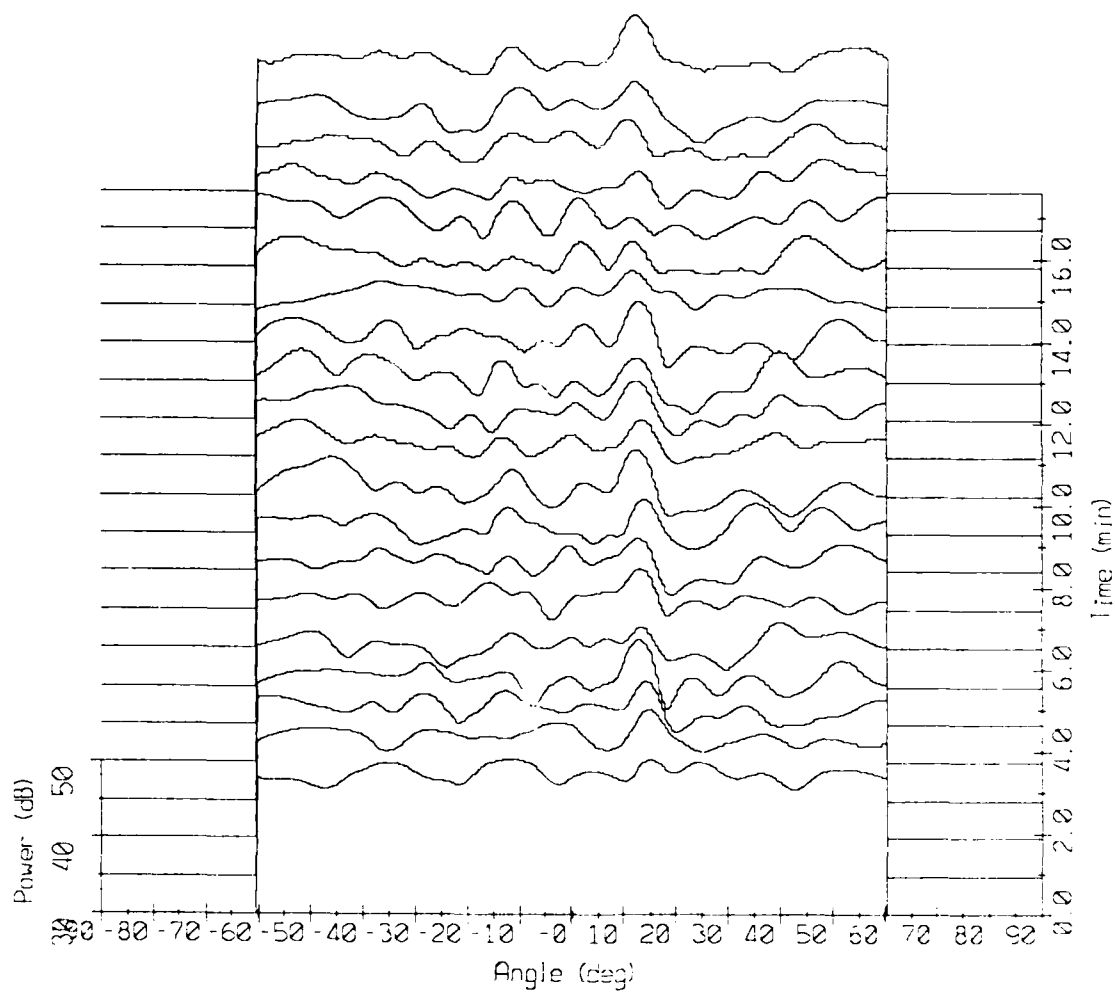
Array Response - 86060 Bin #5490
 $f = 200$ Hz, KB window ($\alpha = 1.5$)



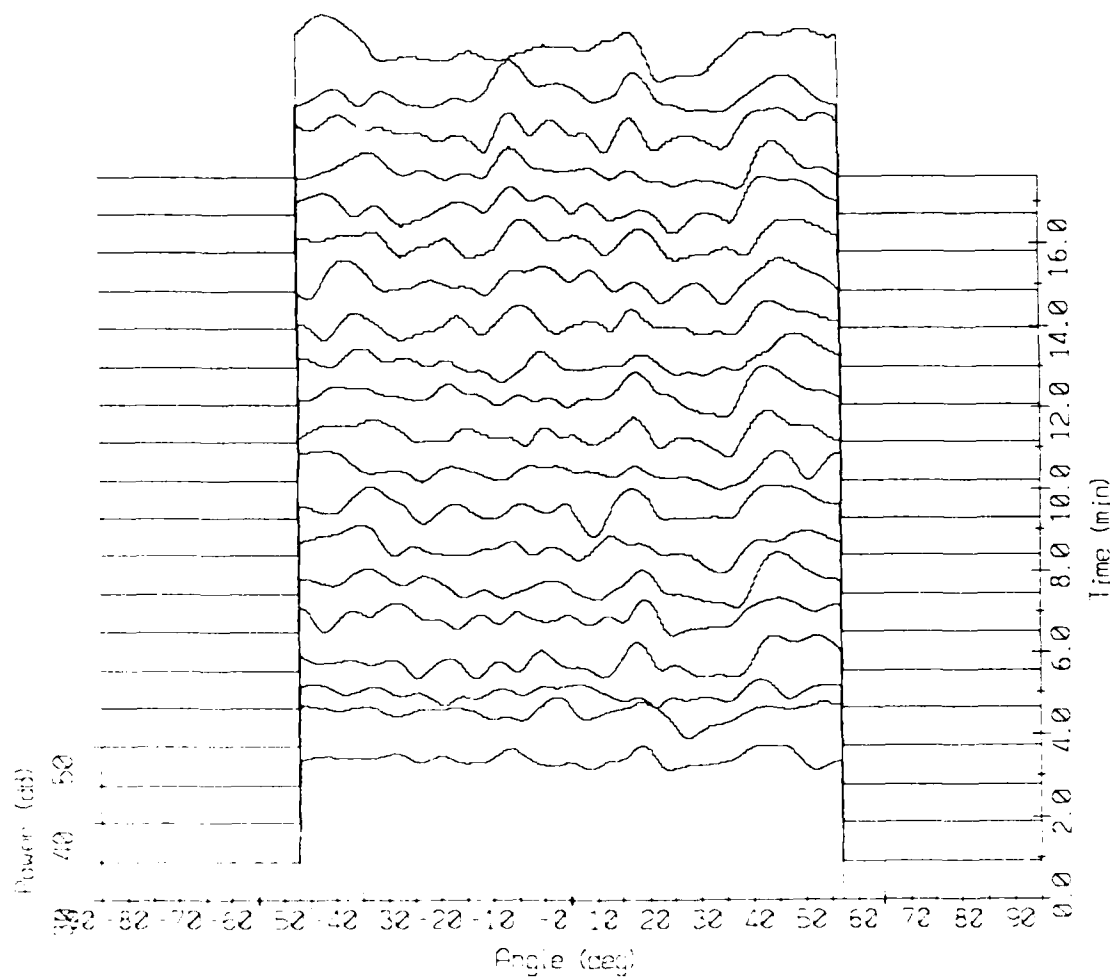
Array Response - 86060 Bin #5664
 $f = 225$ Hz, KB window ($\alpha = 1.5$)



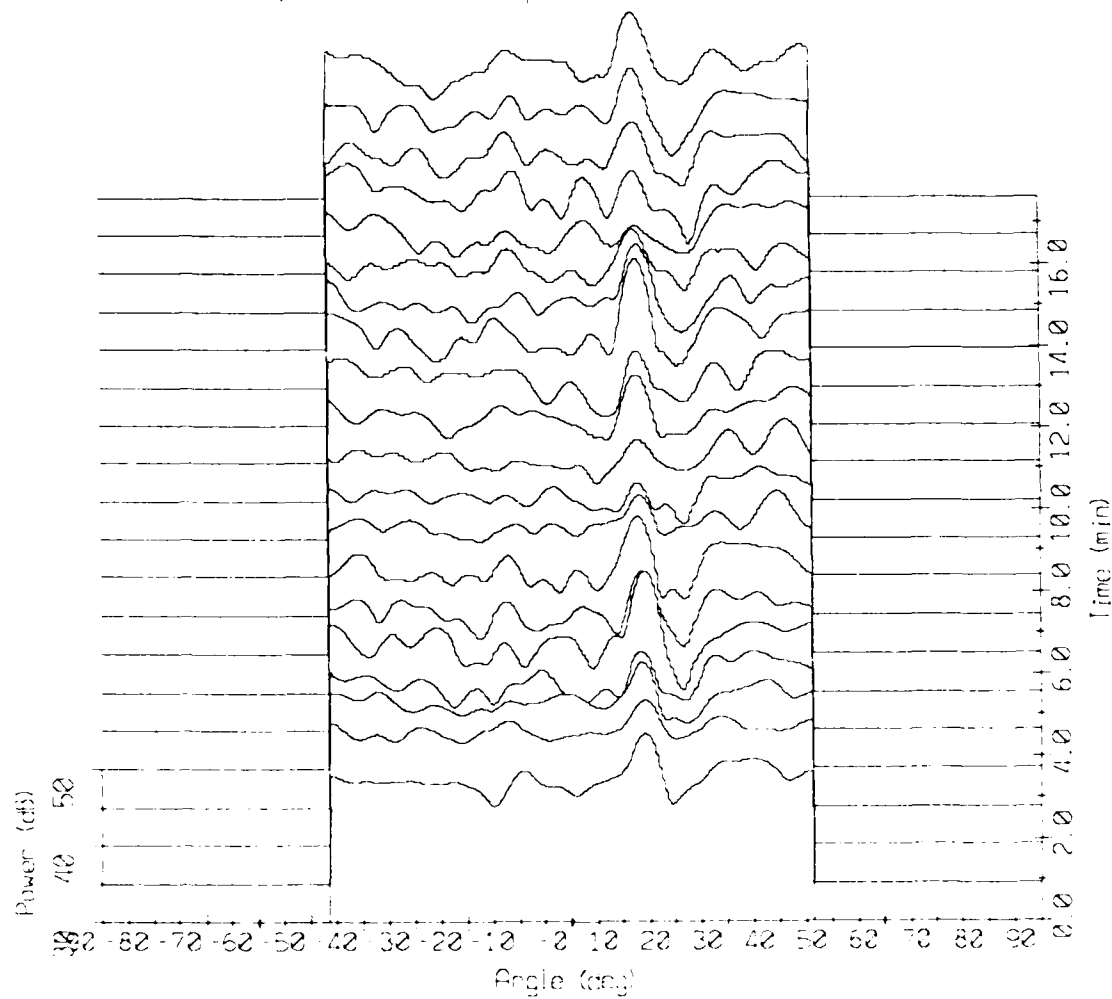
Array Response - 86060 Bin #5832
 $f = 250$ Hz, KB window ($\alpha = 1.5$)



Array Response - 86060 Bin #6012
 $f = 275$ Hz, KB window ($\alpha = 1.5$)



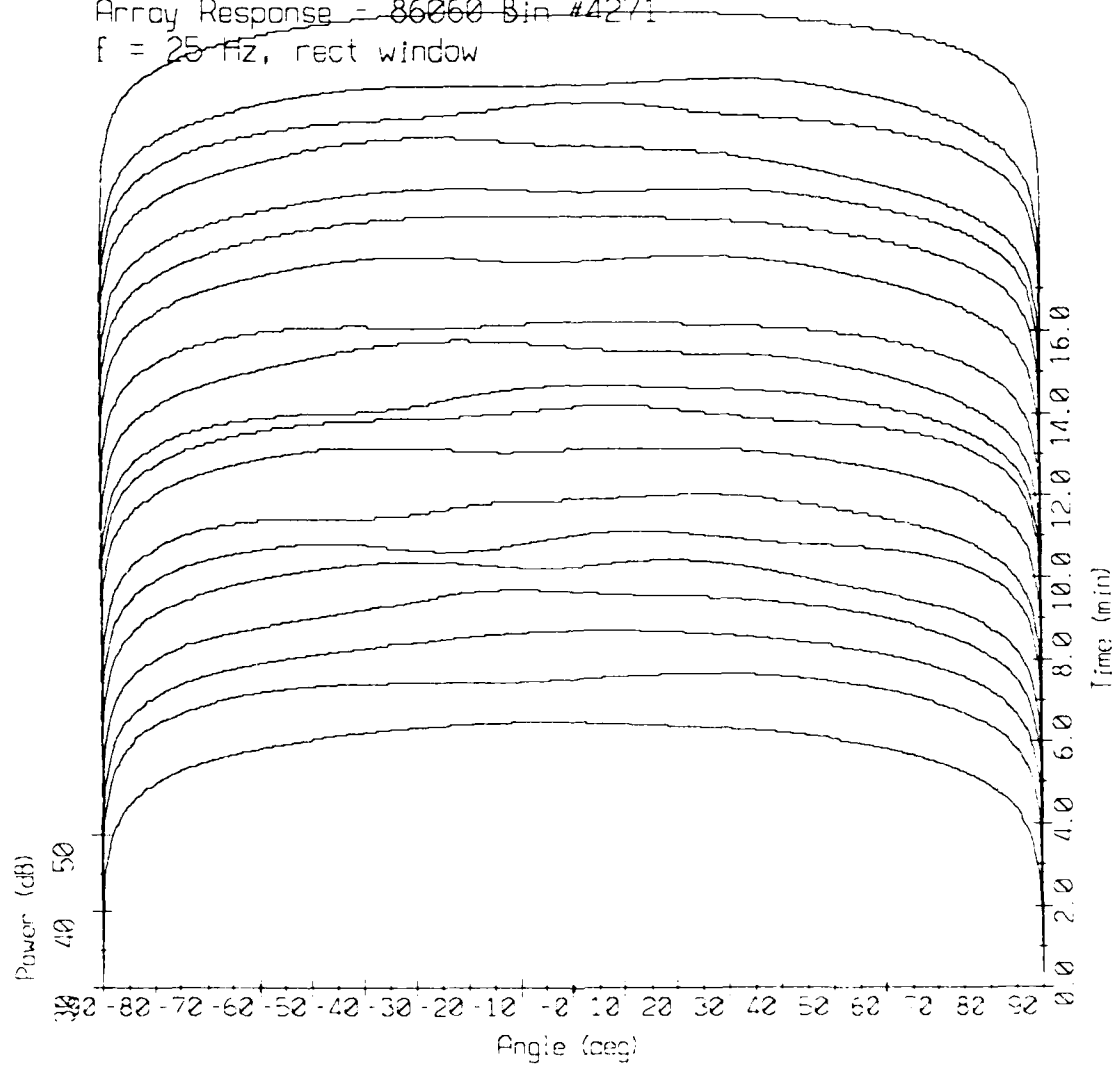
Array Response - 86060 Bin #6186
 $f = 320$ Hz, KB window ($\alpha = 1.5$)



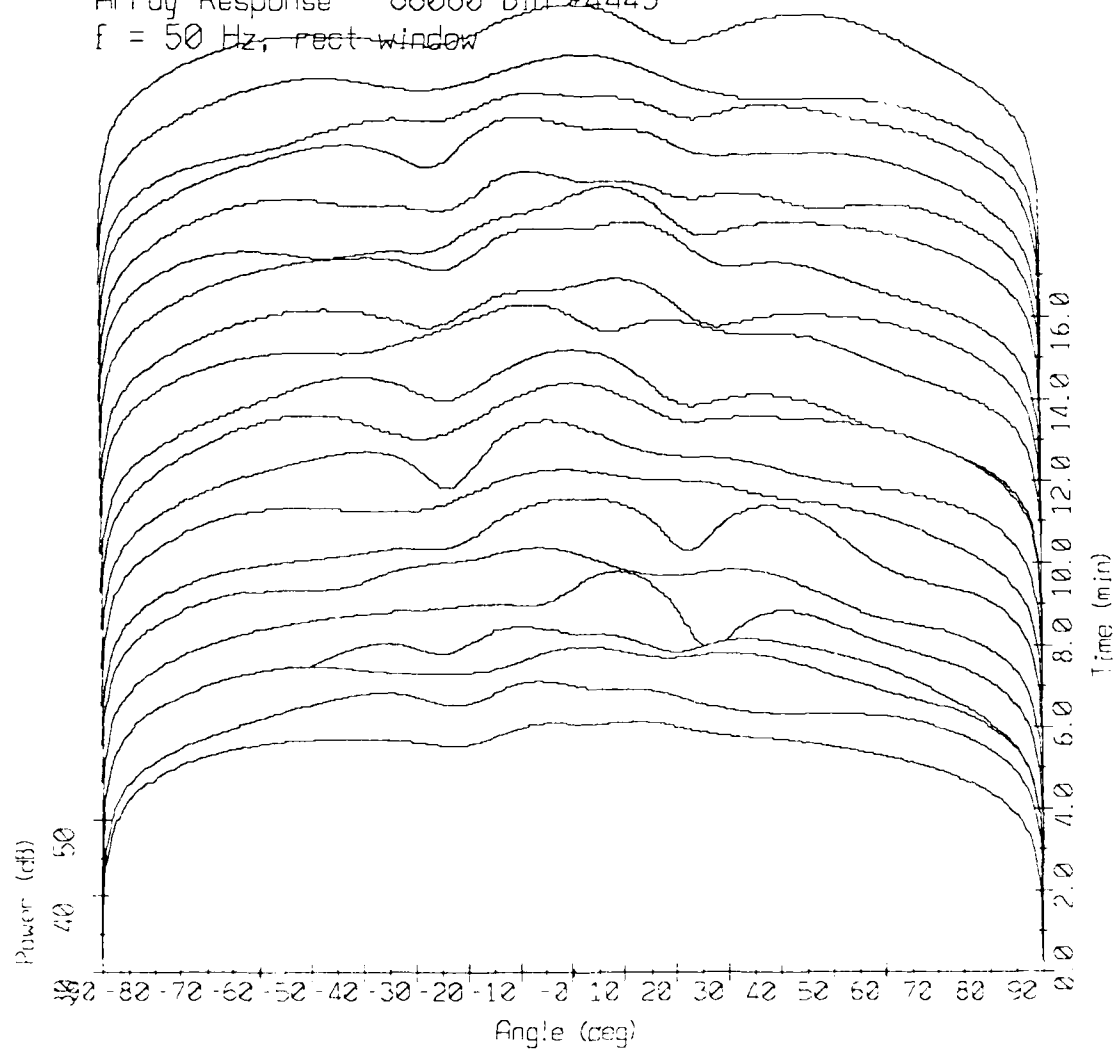
V. Array Response: Waterfall, Rect Window.

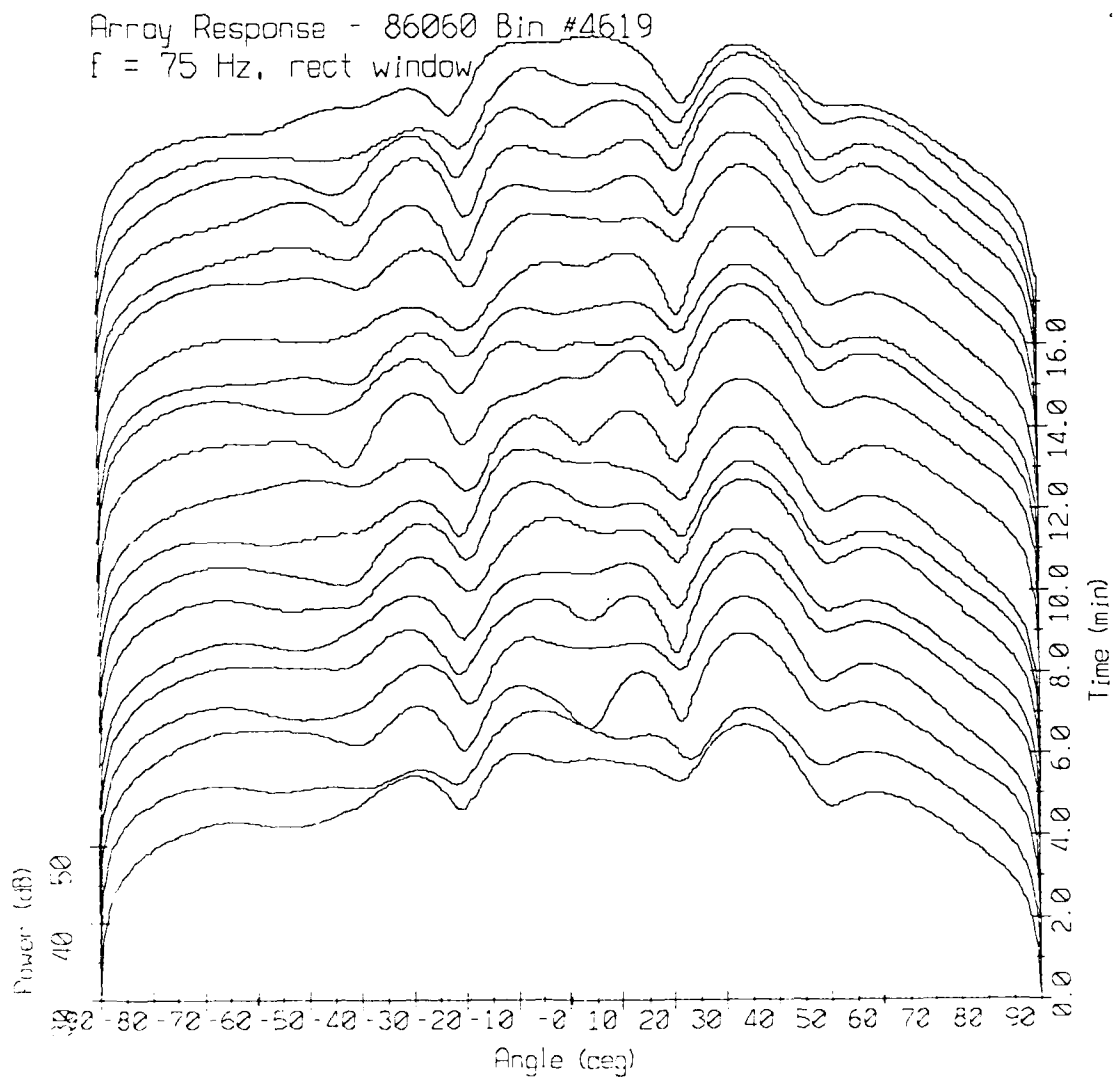
Array Response - ~~86060~~ Bin #4271

$f = 25$ Hz, rect window

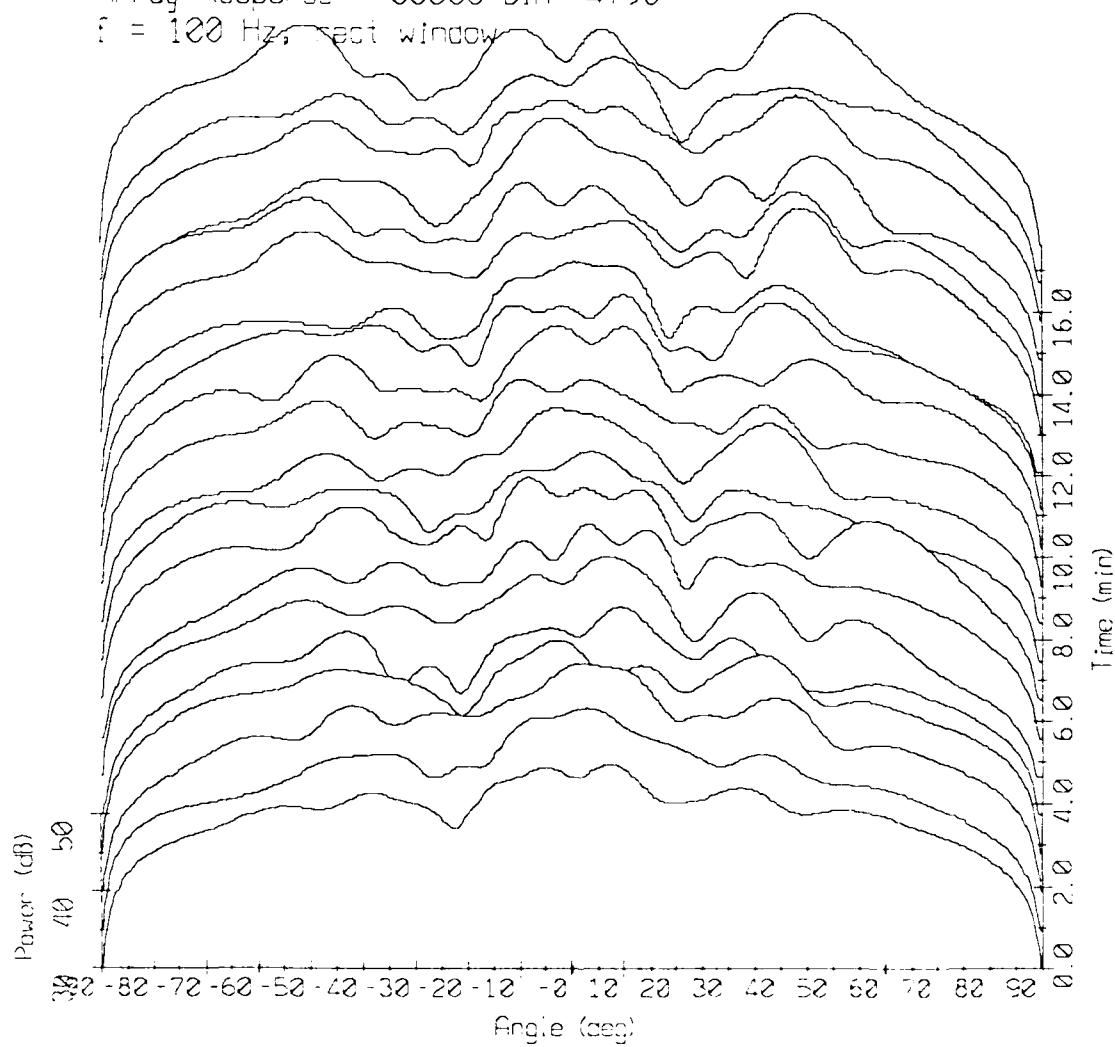


Array Response - 86060 Bin #4445
 $f = 50$ Hz, rect window

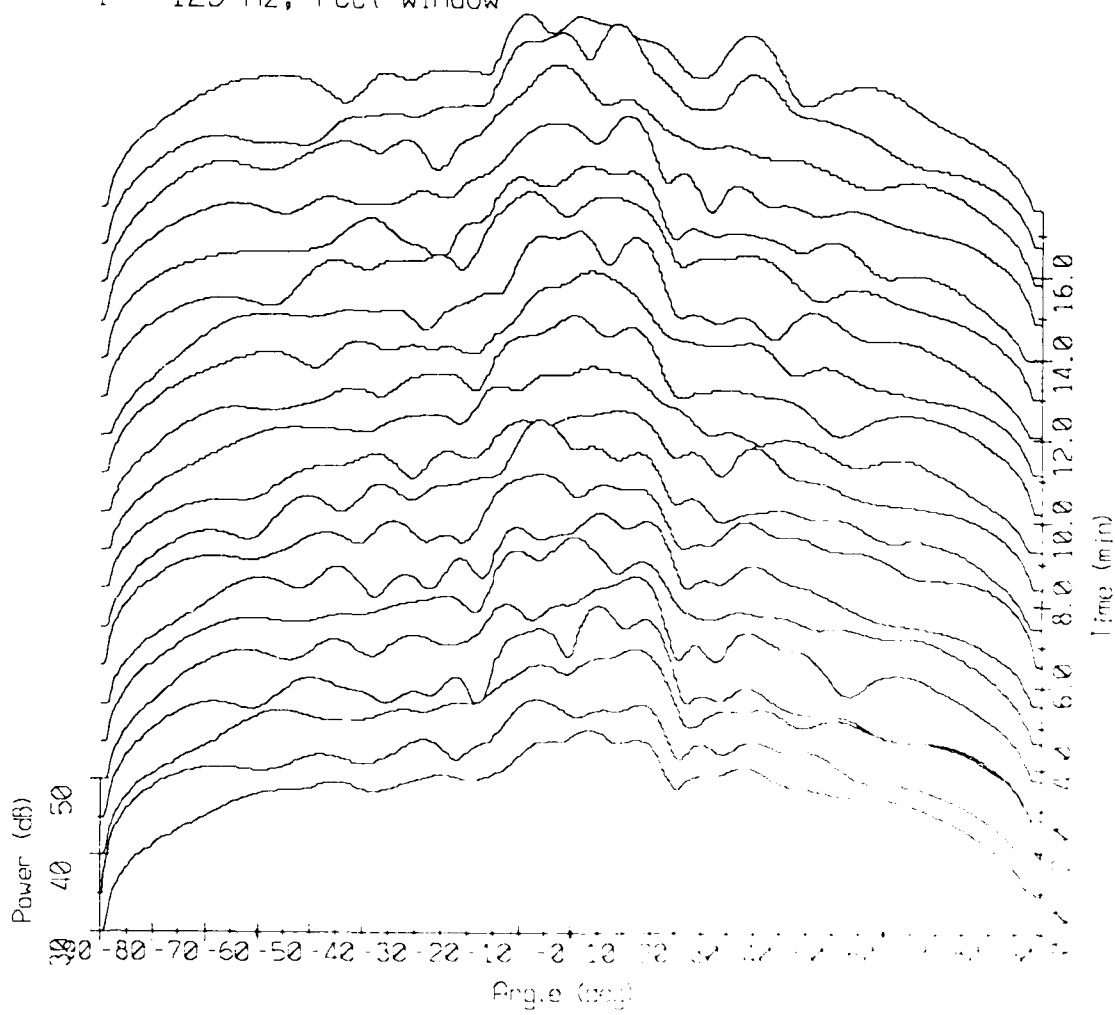




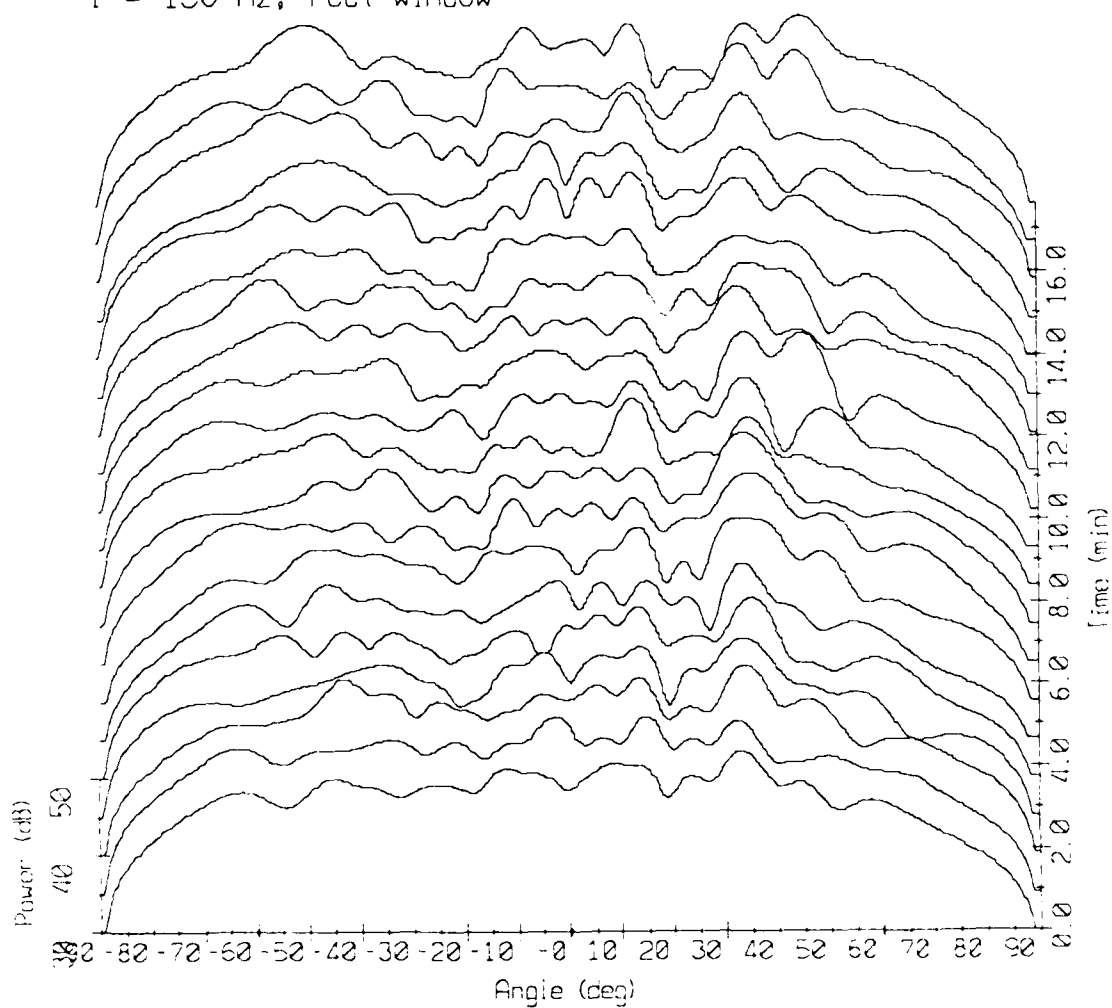
Array Response - 86260 Bin #4793
f = 100 Hz, rect window



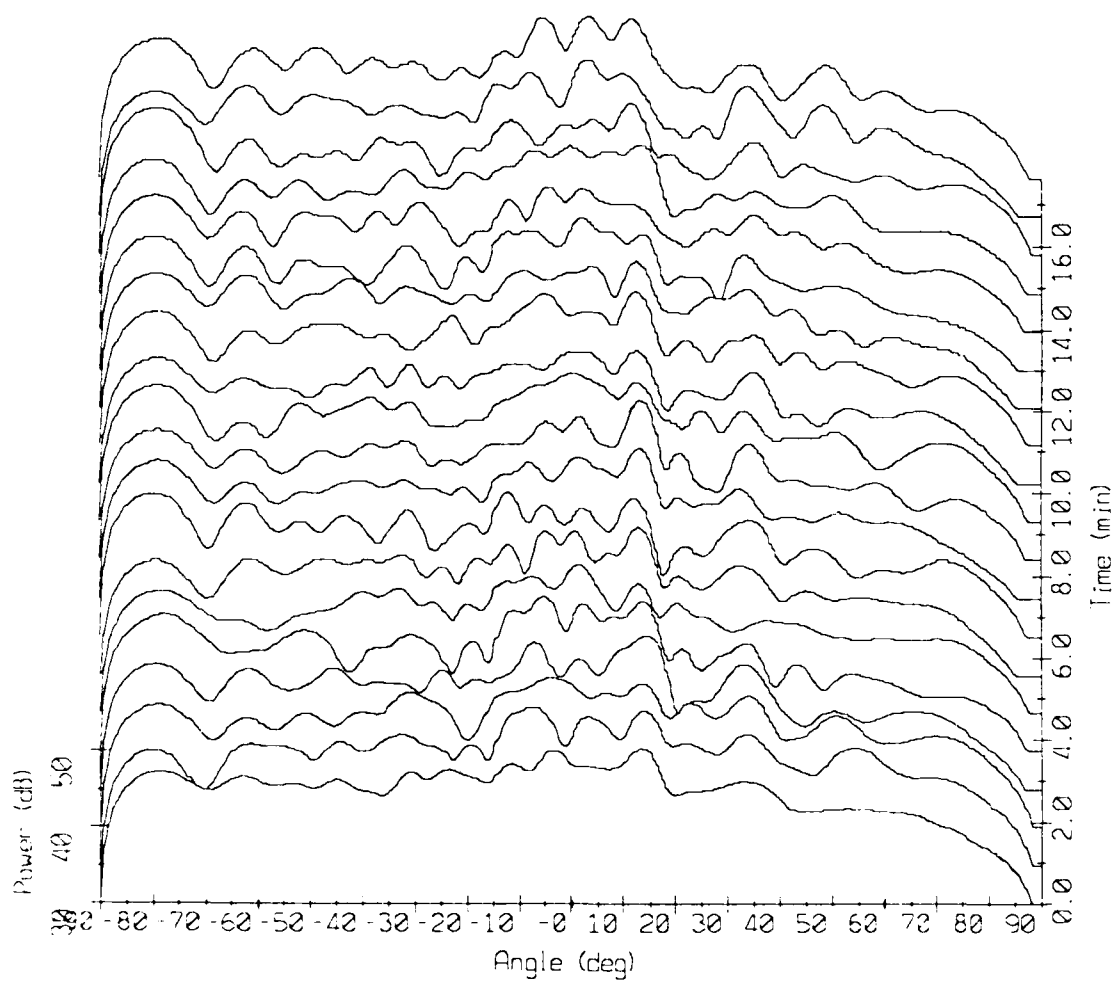
Array Response - 86260 Bin #4967
 $f = 125$ Hz, rect window



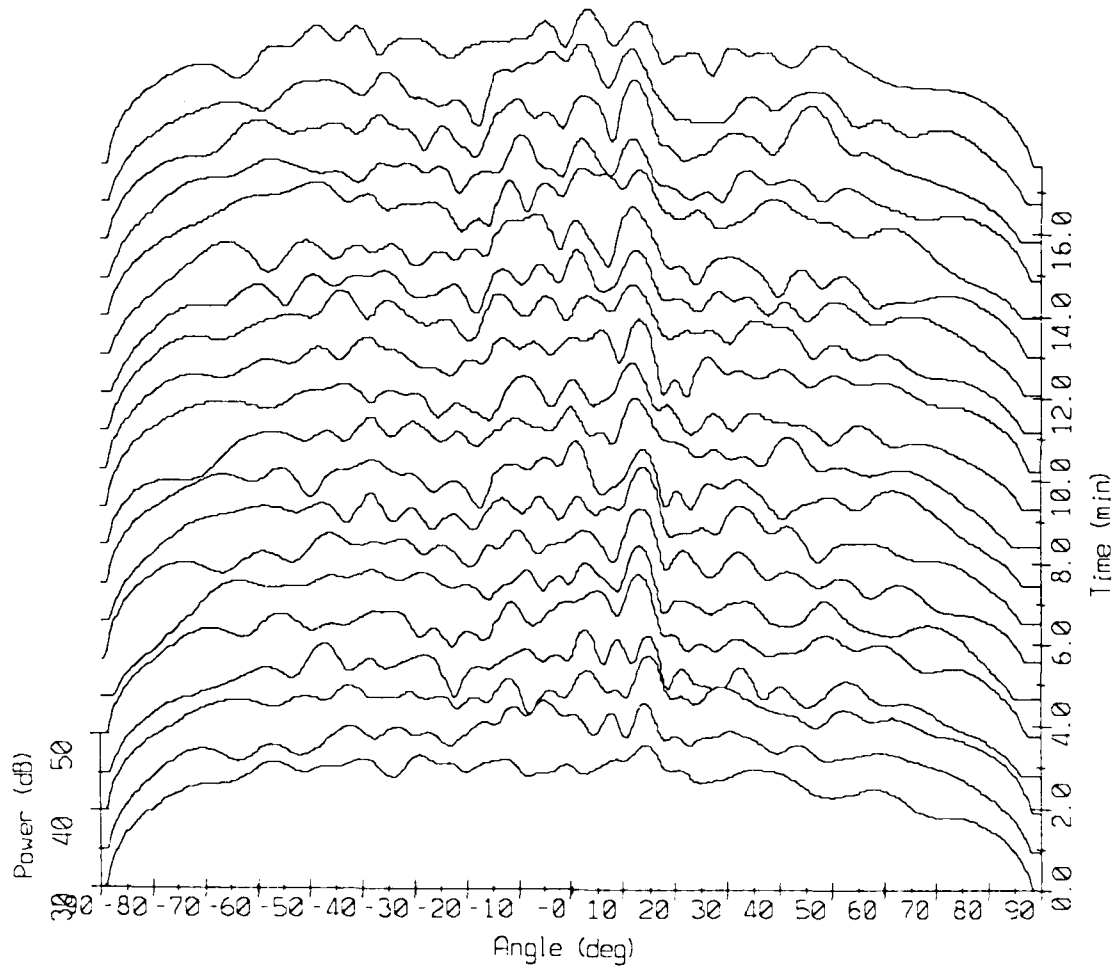
Array Response - 86060 Bin #5141
f = 150 Hz, rect window



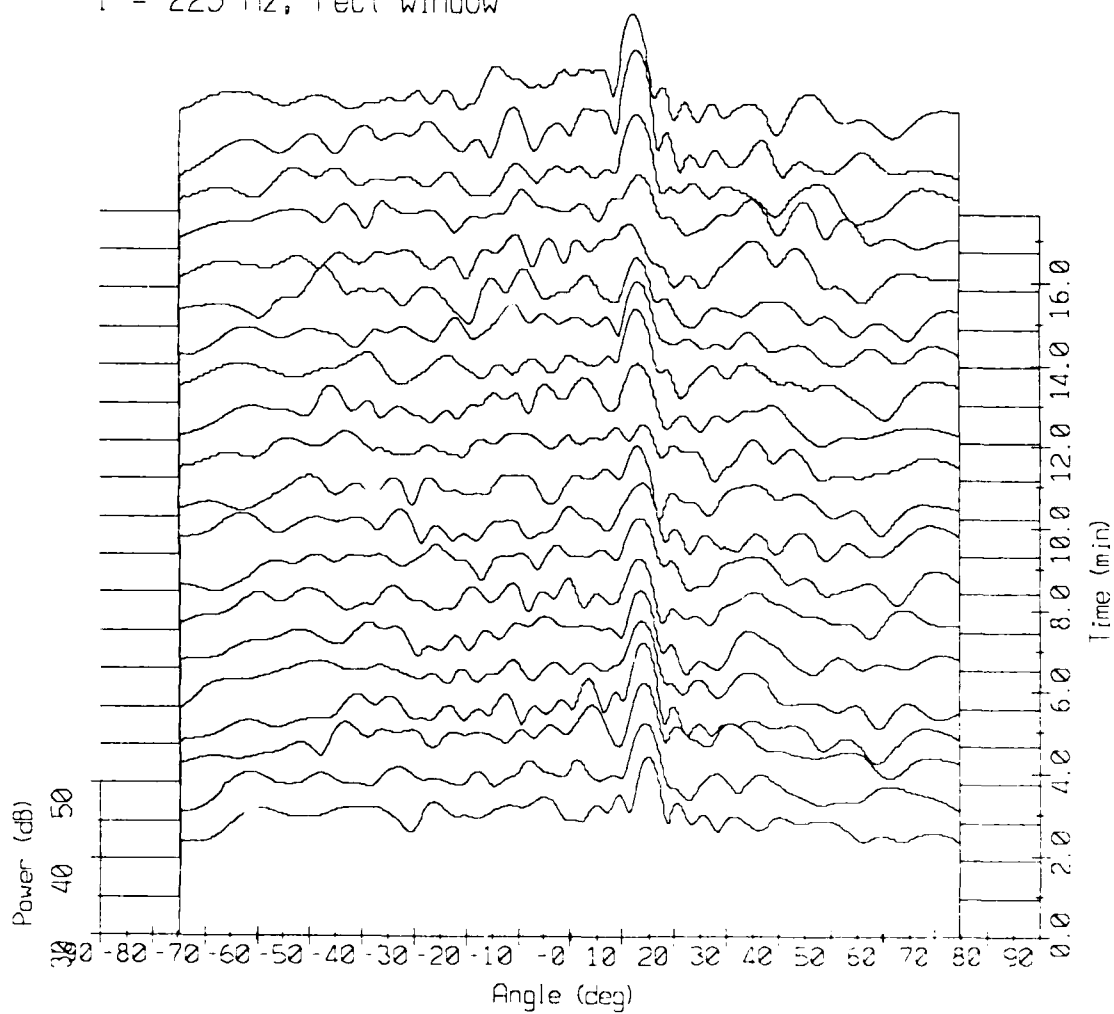
Array Response - 86060 Bin #5316
f = 175 Hz, rect window



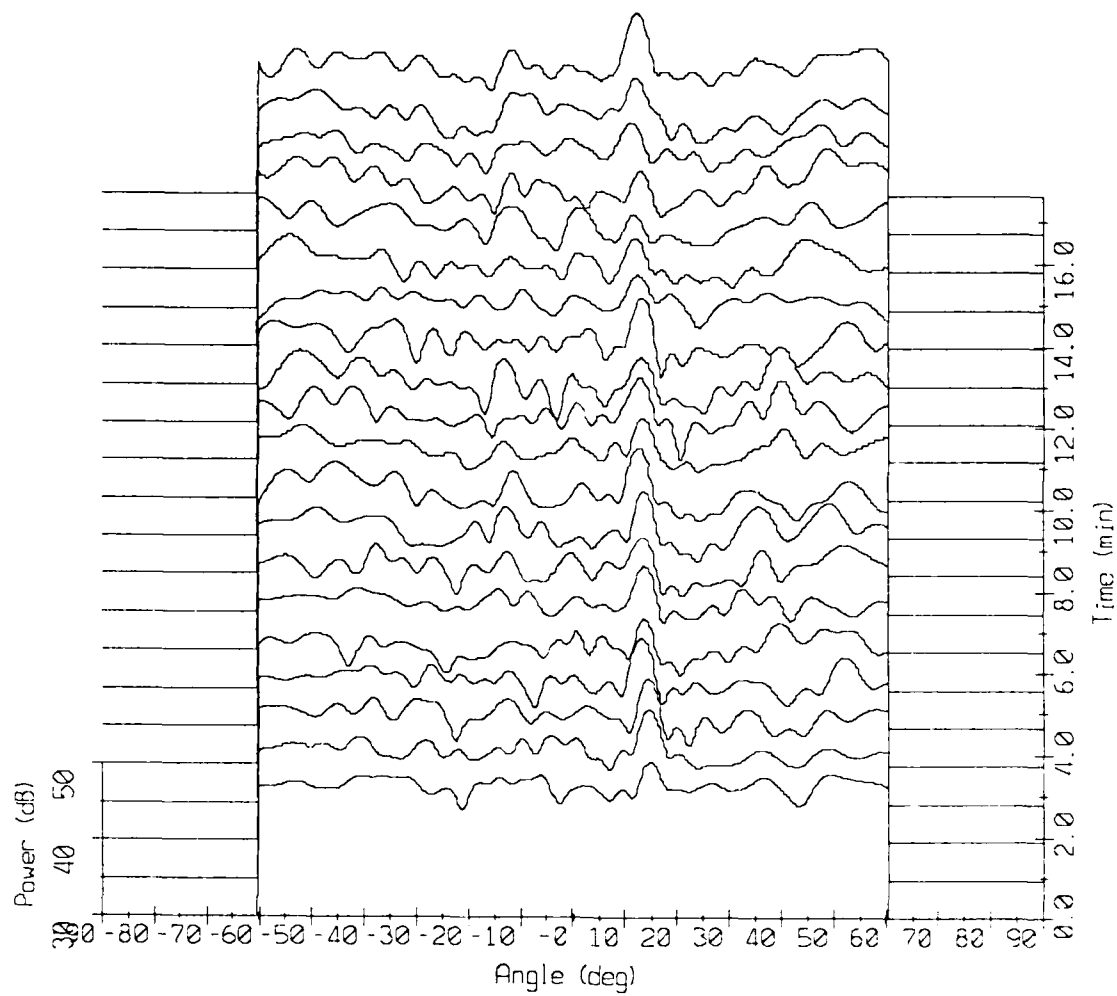
Array Response - 86060 Bin #5490
f = 200 Hz, rect window



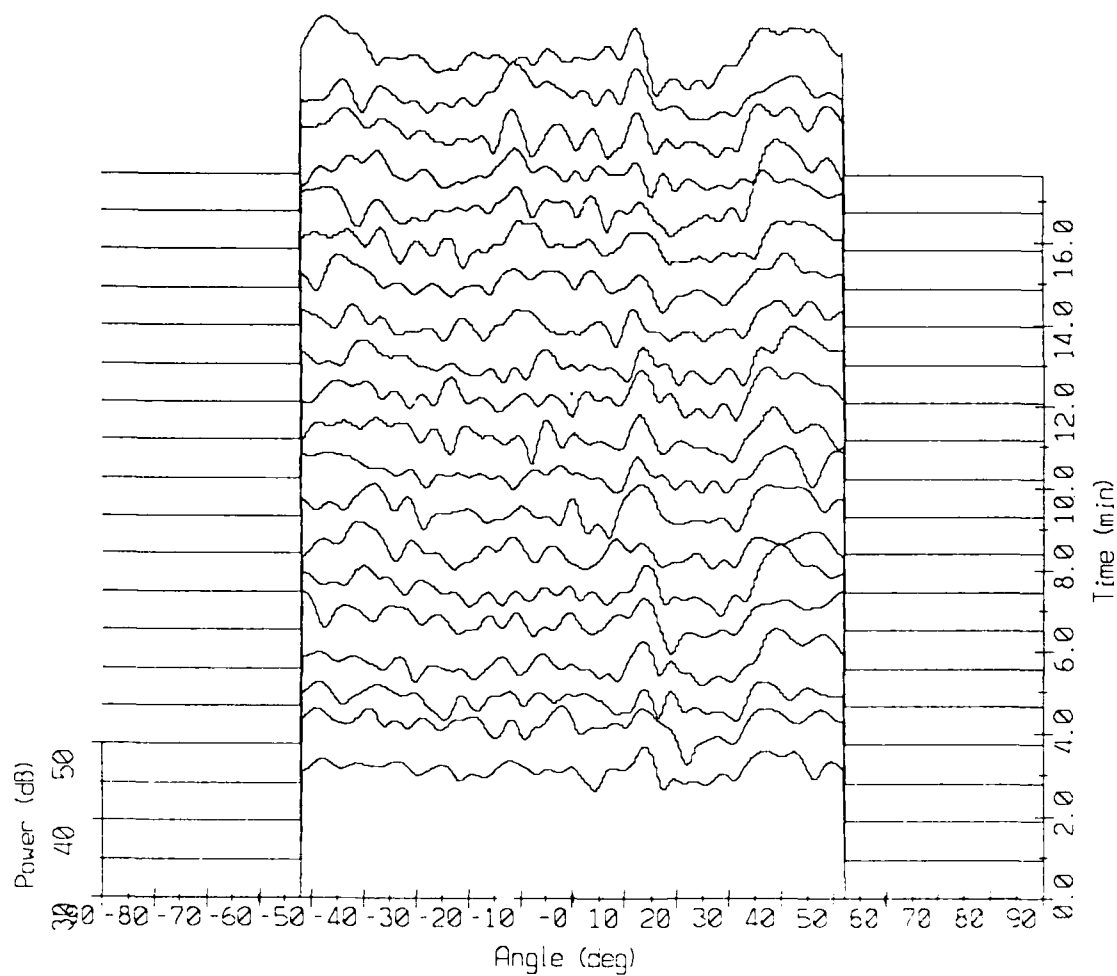
Array Response - 86060 Bin #5664
 $f = 225$ Hz, rect window



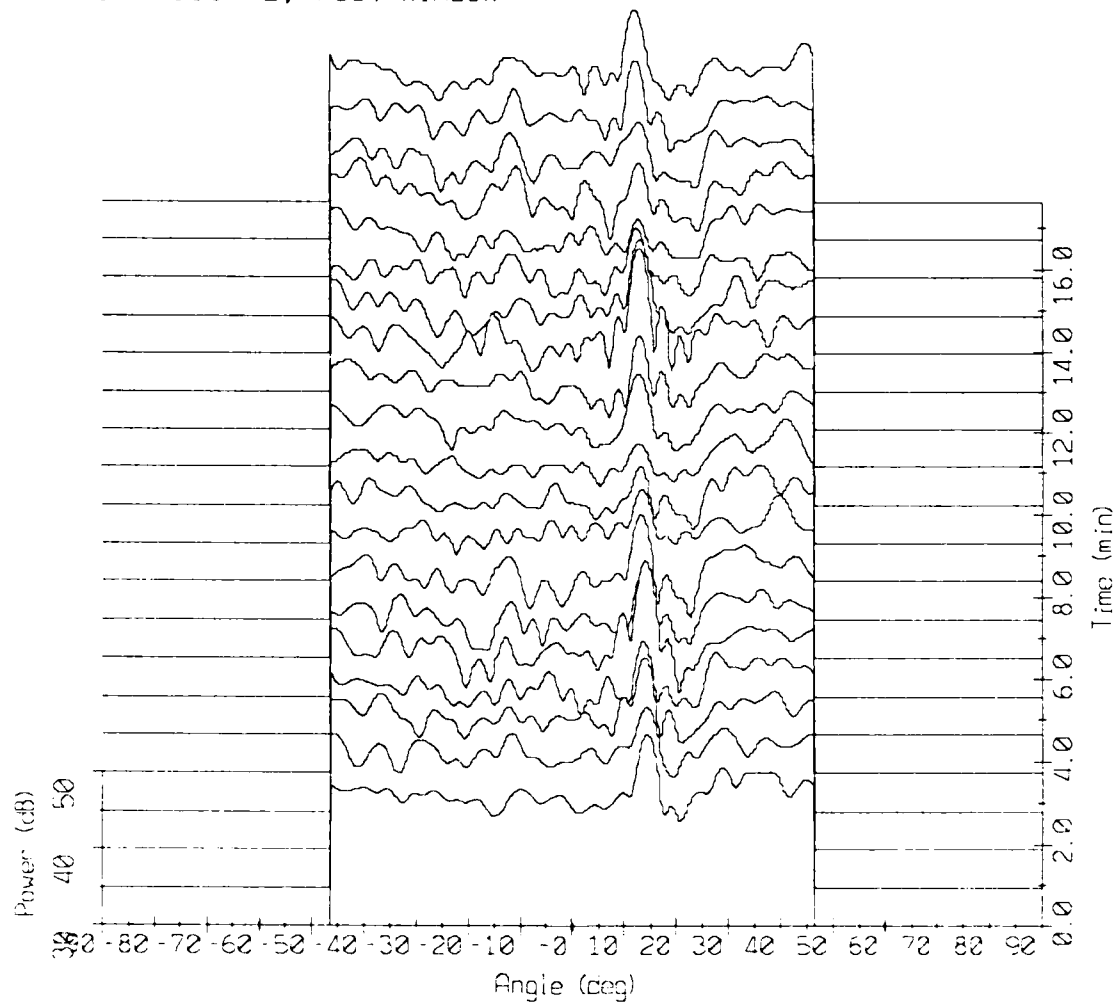
Array Response - 86060 Bin #5832
 $f = 250$ Hz, rect window



Array Response - 86060 Bin #6012
 $f = 275$ Hz, rect window



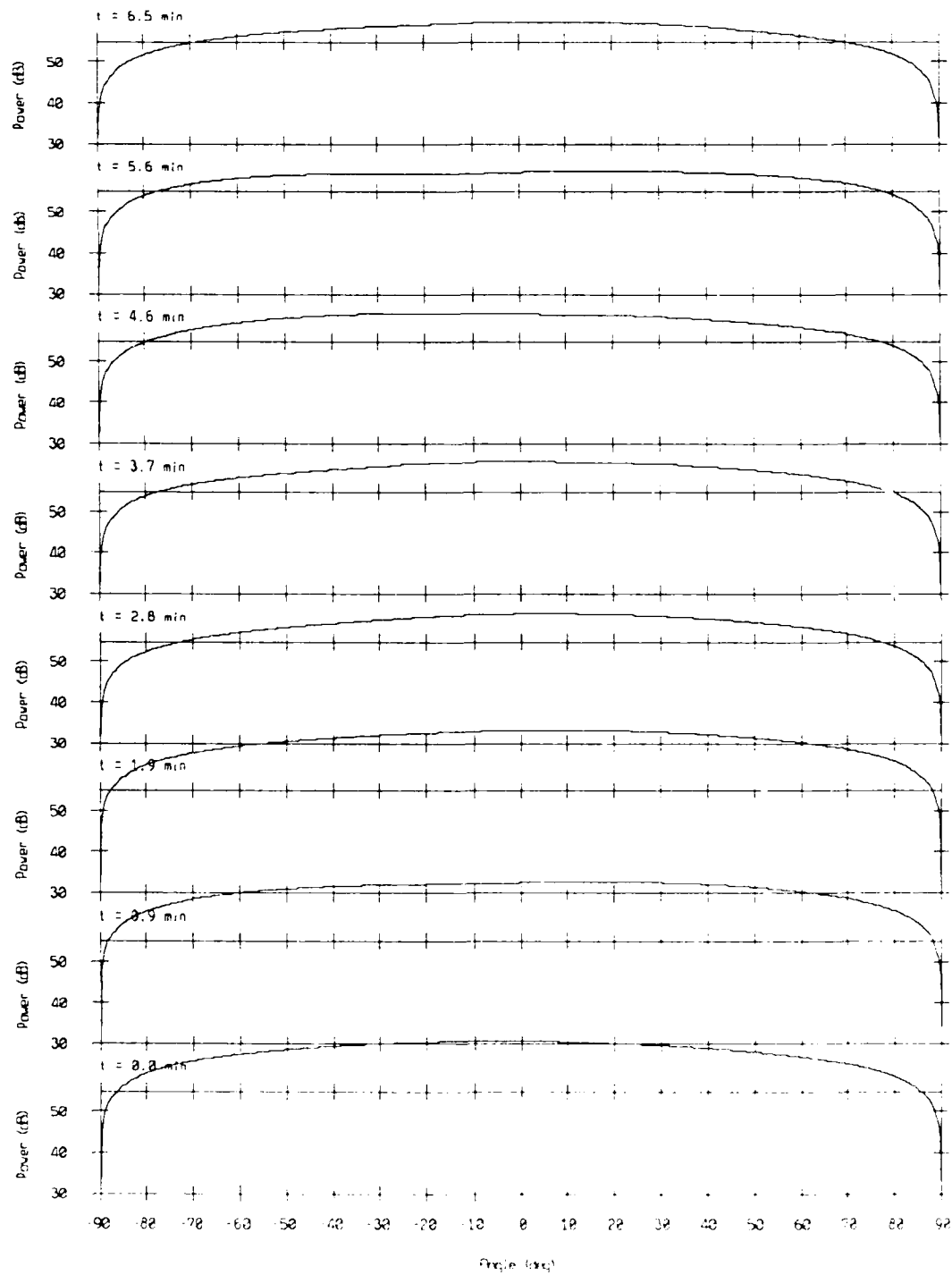
Array Response - 86060 Bin #6186
 $f = 300$ Hz, rect window



VI. Array Response: Panels, KB Window.

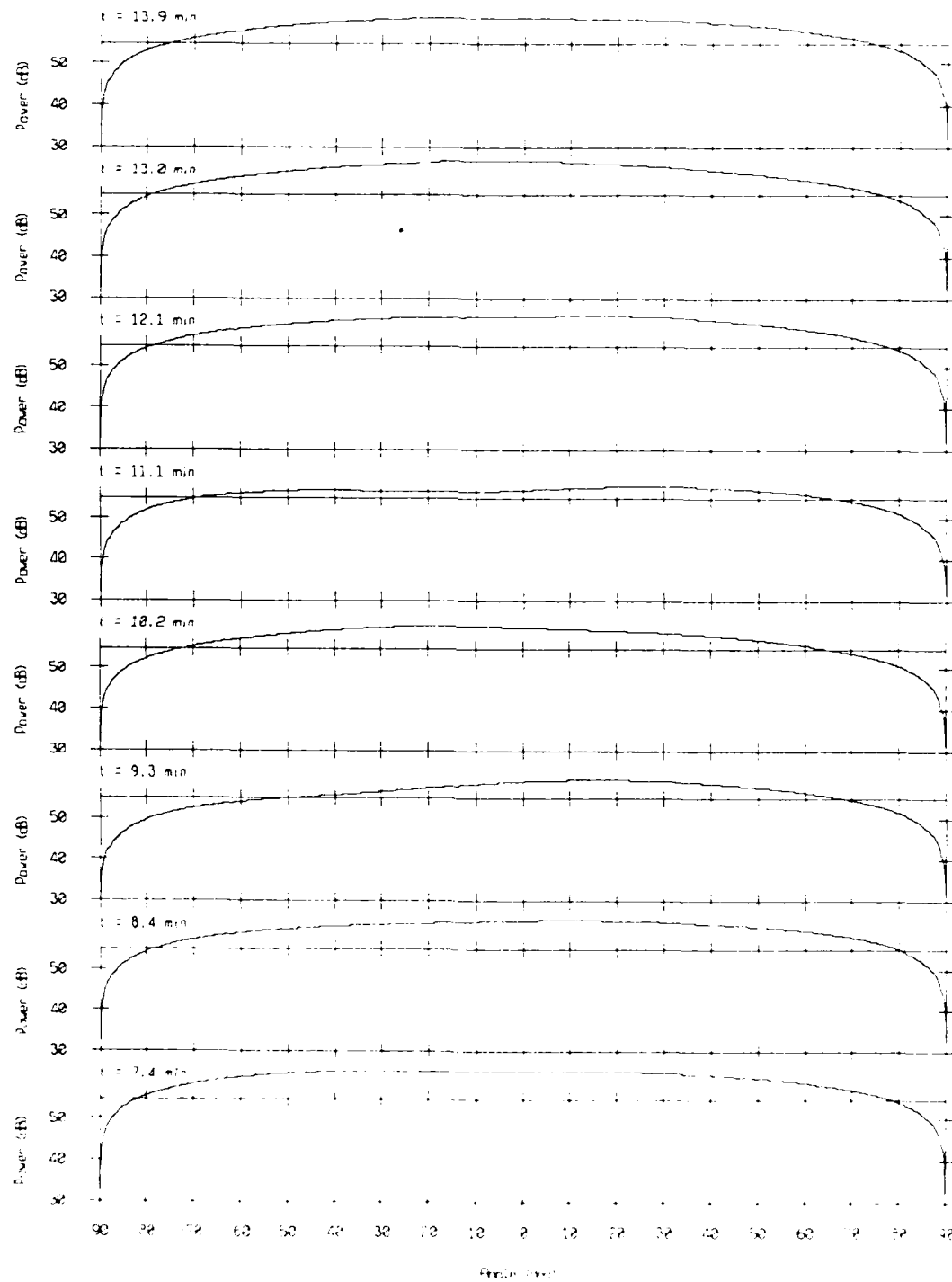
Array Response - 86060 Bin #4271

$f = 25$ Hz, KB window ($\alpha = 1.5$)



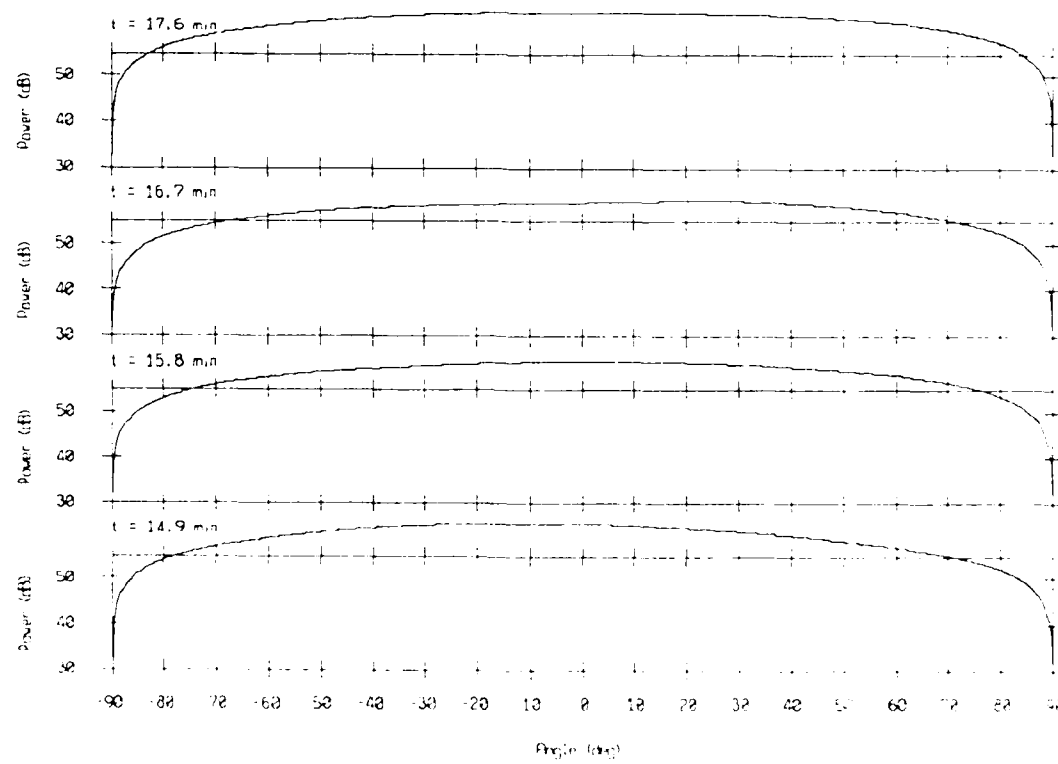
Array Response - 86260 Bin #4271

$f = 25$ Hz, K8 window ($\alpha = 1.5$)



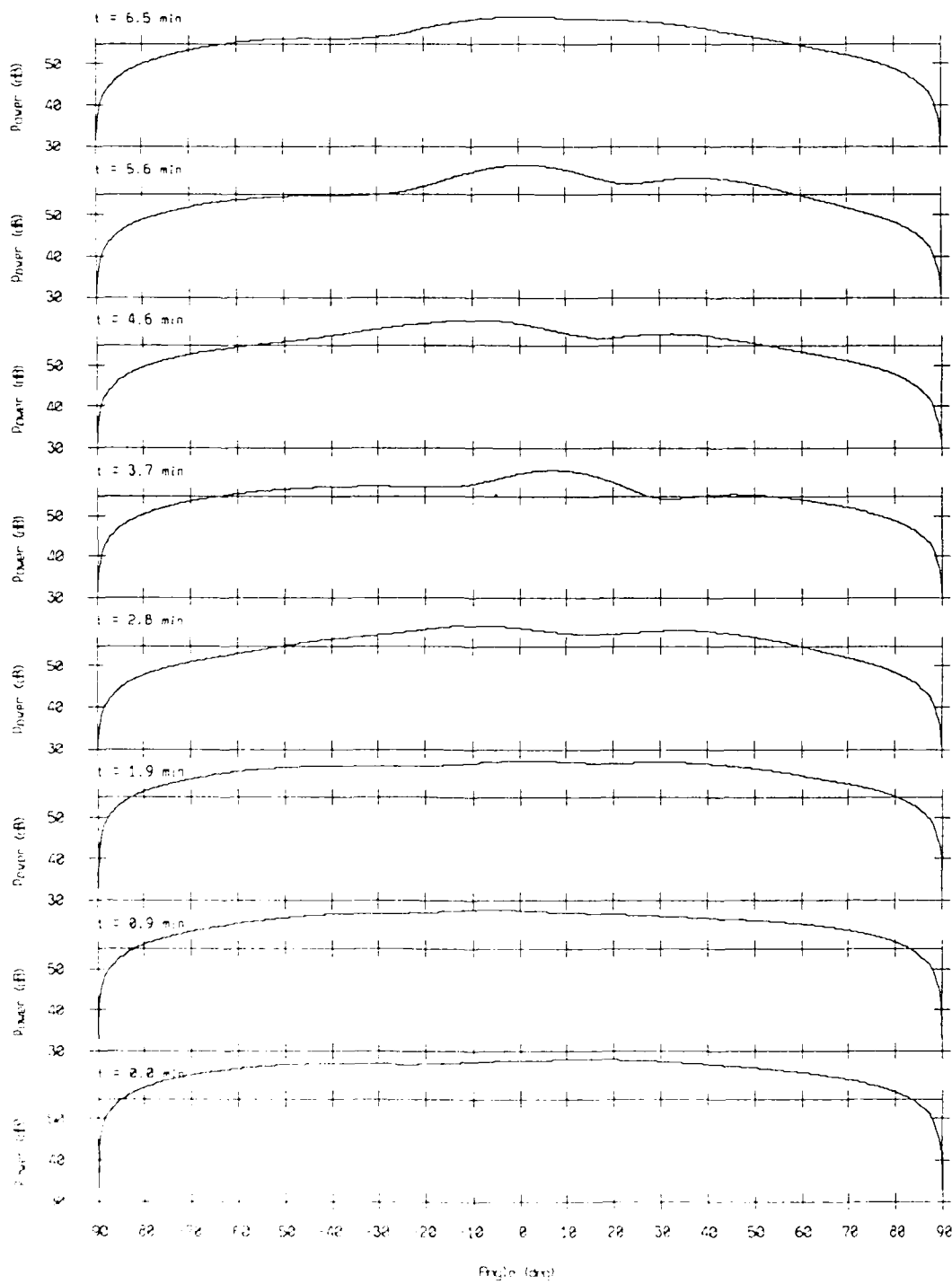
Array Response - 86060 Bin #4271

$f = 25$ Hz, KB window ($\alpha = 1.5$)



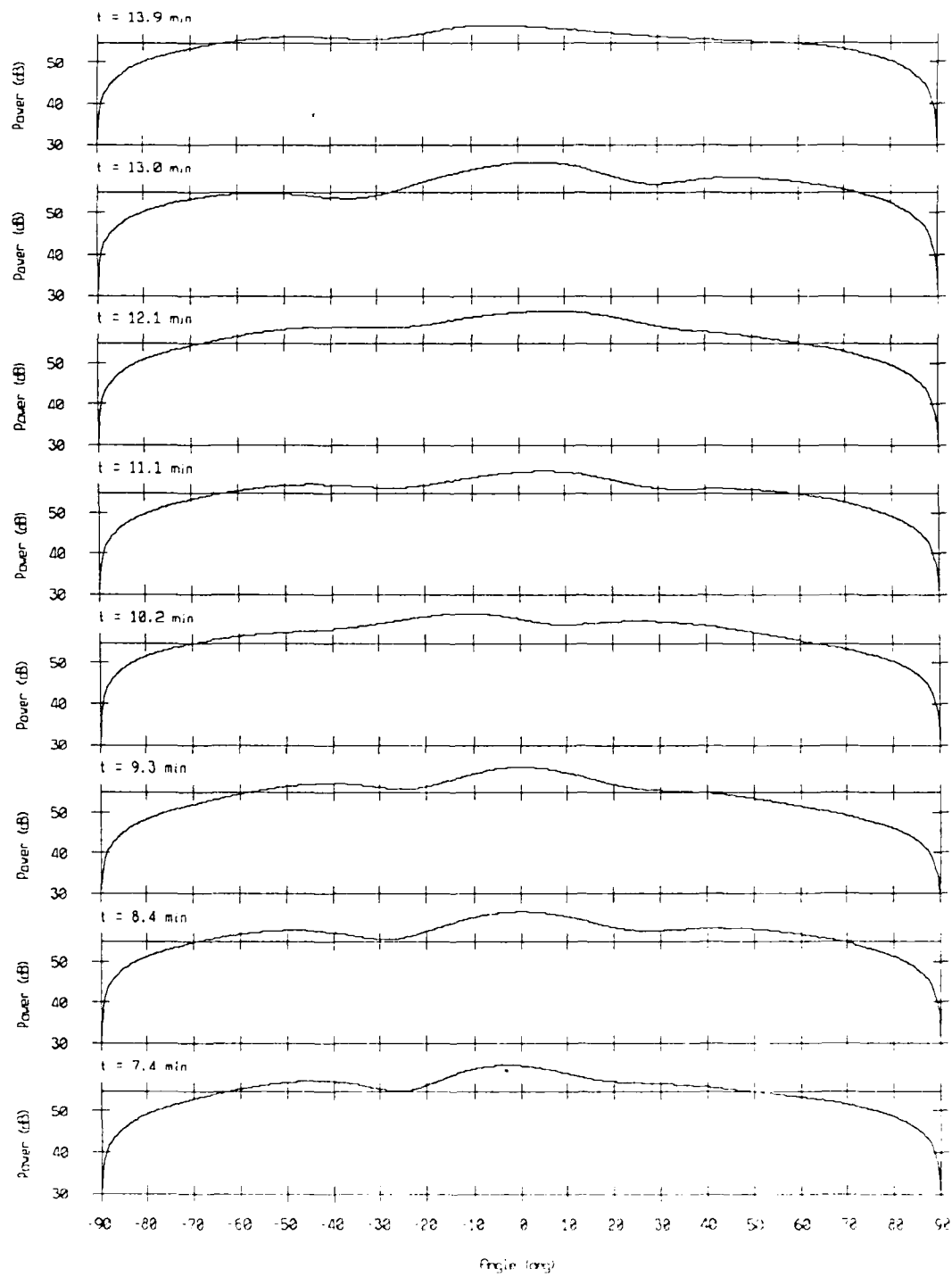
Array Response - 86060 Bin #4445

$f = 50$ Hz, KB window ($\alpha = 1.5$)



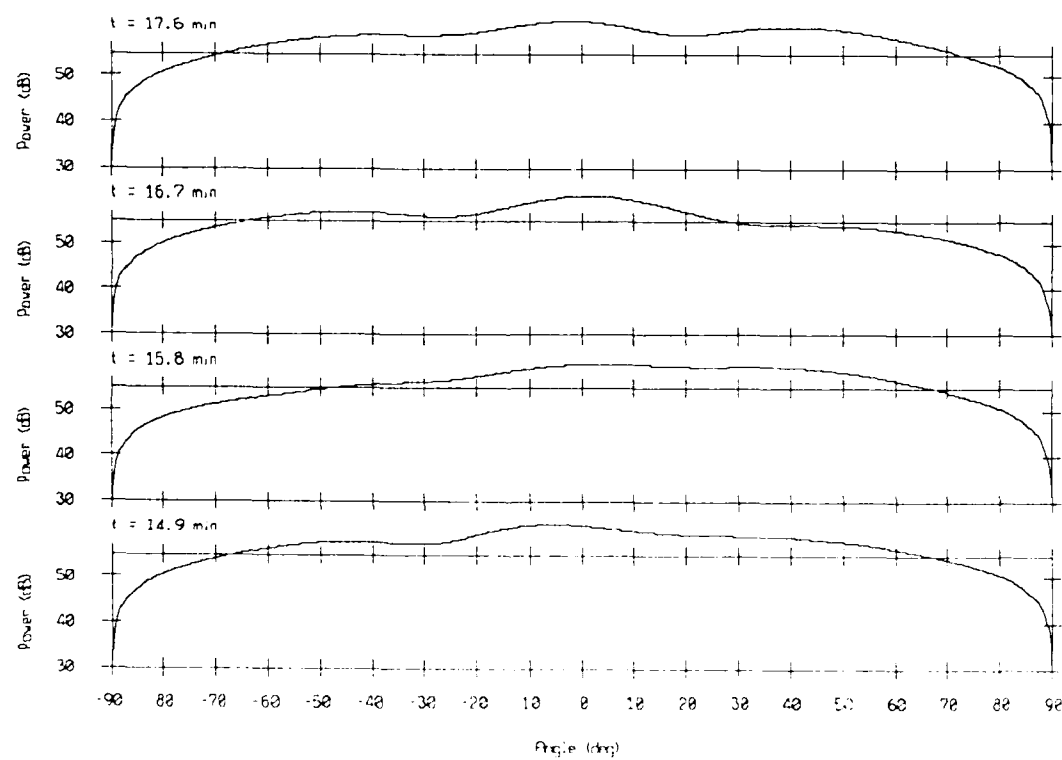
Array Response - 86060 Bin #4445

$f = 50$ Hz, KB window ($\alpha = 1.5$)



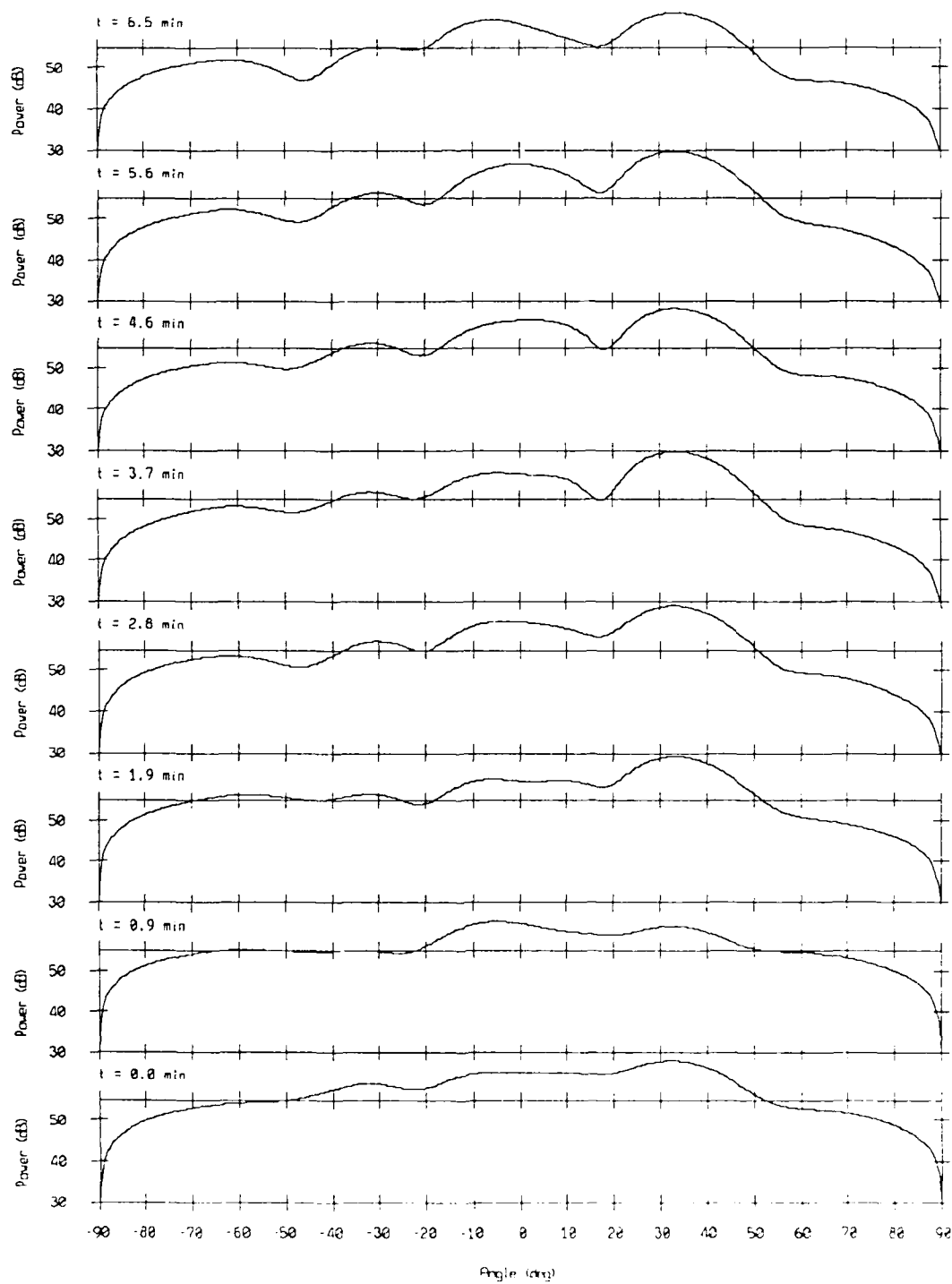
Array Response - 86060 Bin #4445

$f = 50$ Hz, KB window ($\alpha = 1.5$)



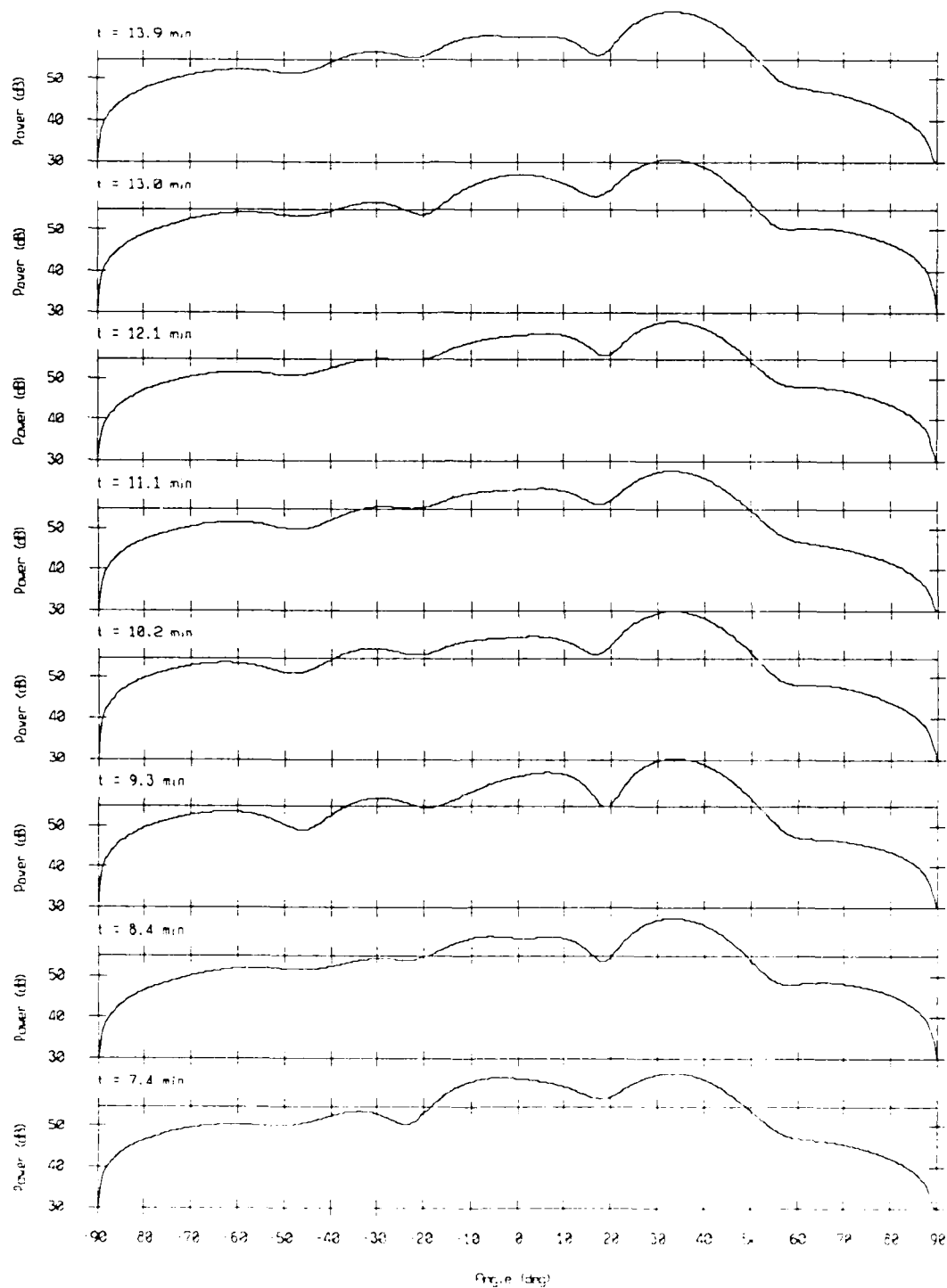
Array Response - 86060 Bin #4619

$f = 75$ Hz, KB window ($\alpha = 1.5$)



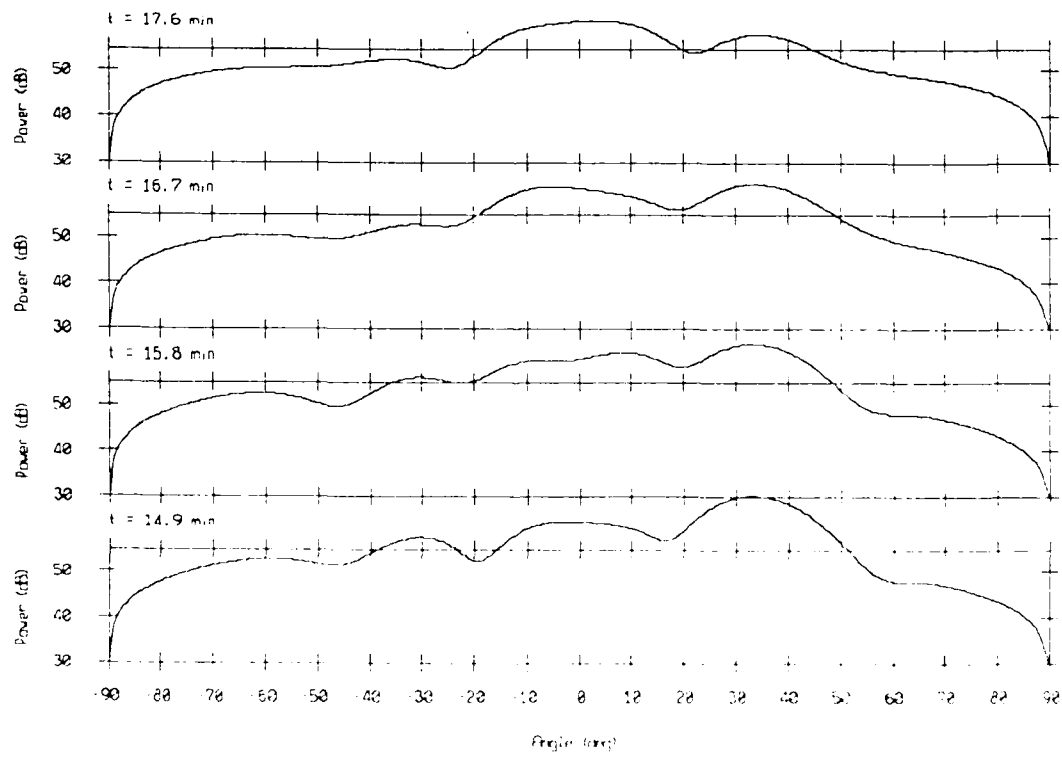
Array Response - 86060 Bin #4619

$f = 75$ Hz, KB window ($\alpha = 1.5$)



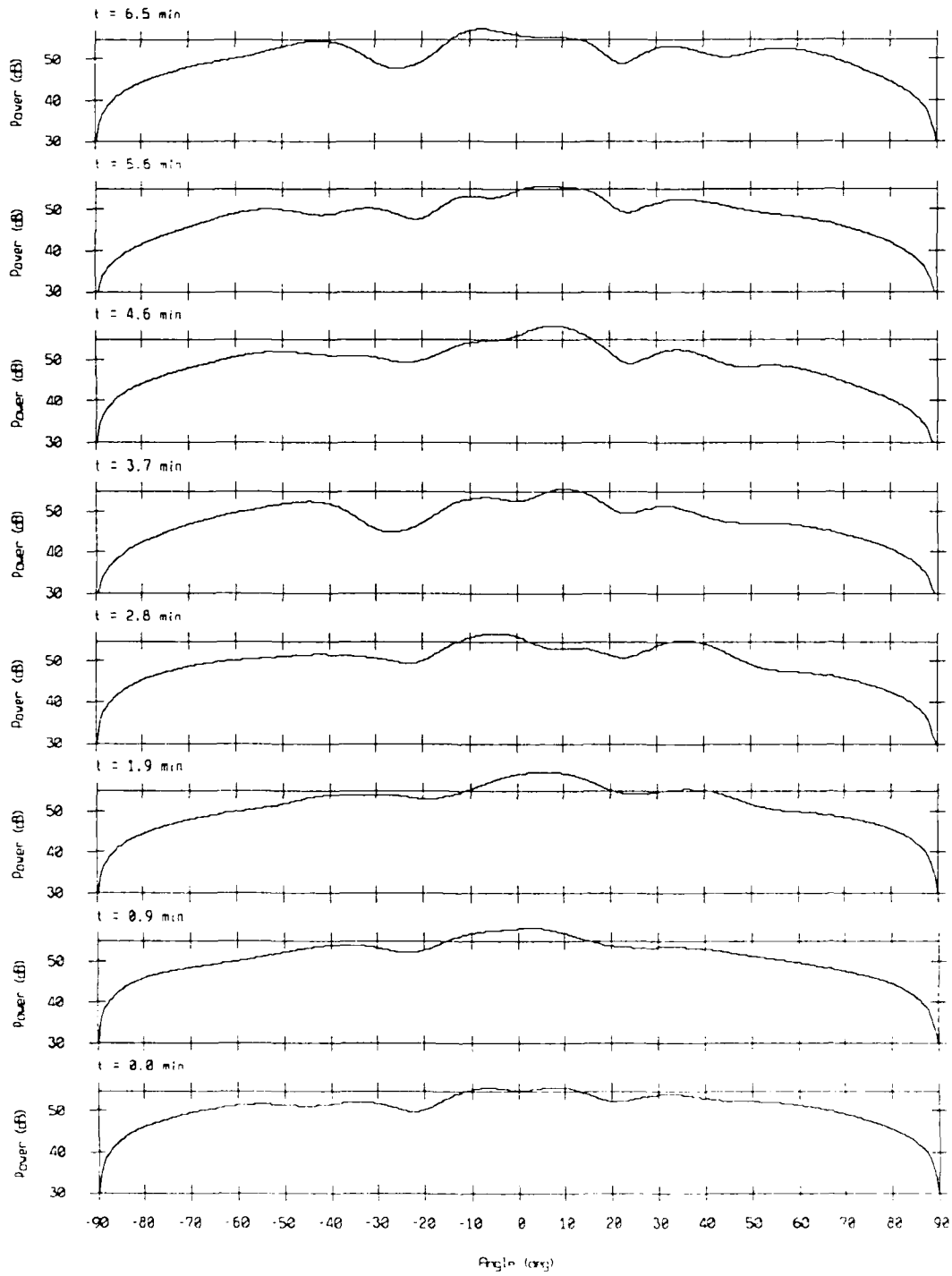
Array Response - 86060 Bin #4619

$f = 75$ Hz, KB window ($\alpha = 1.5$)



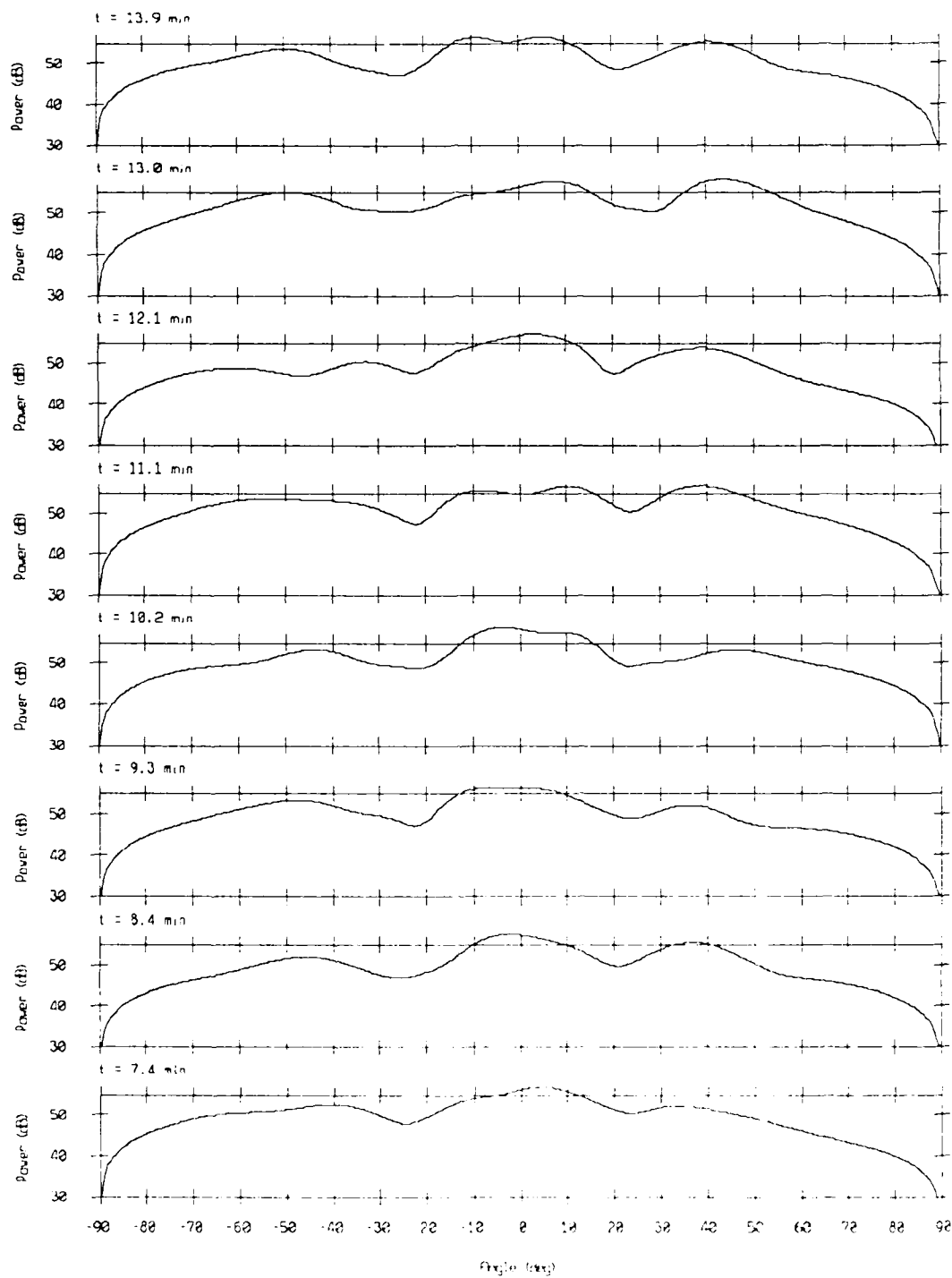
Array Response - 86060 Bin #4793

$f = 100$ Hz, KB window ($\alpha = 1.5$)



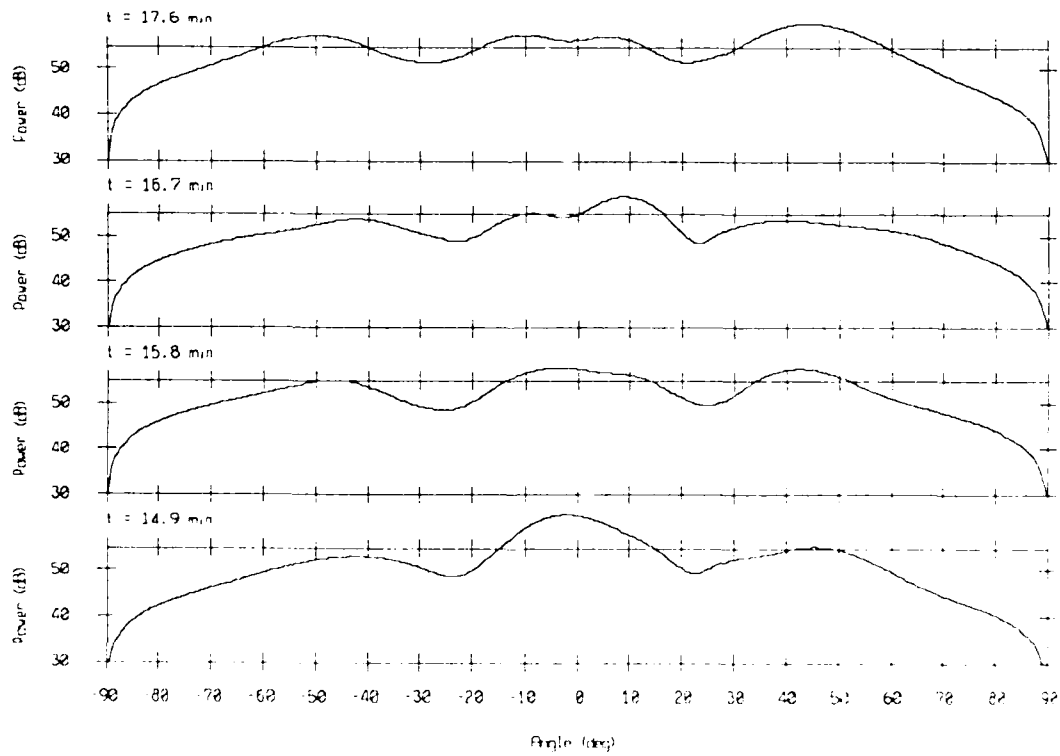
Array Response - 86060 Bin #4793

$f = 100$ Hz, KB window ($\alpha = 1.5$)

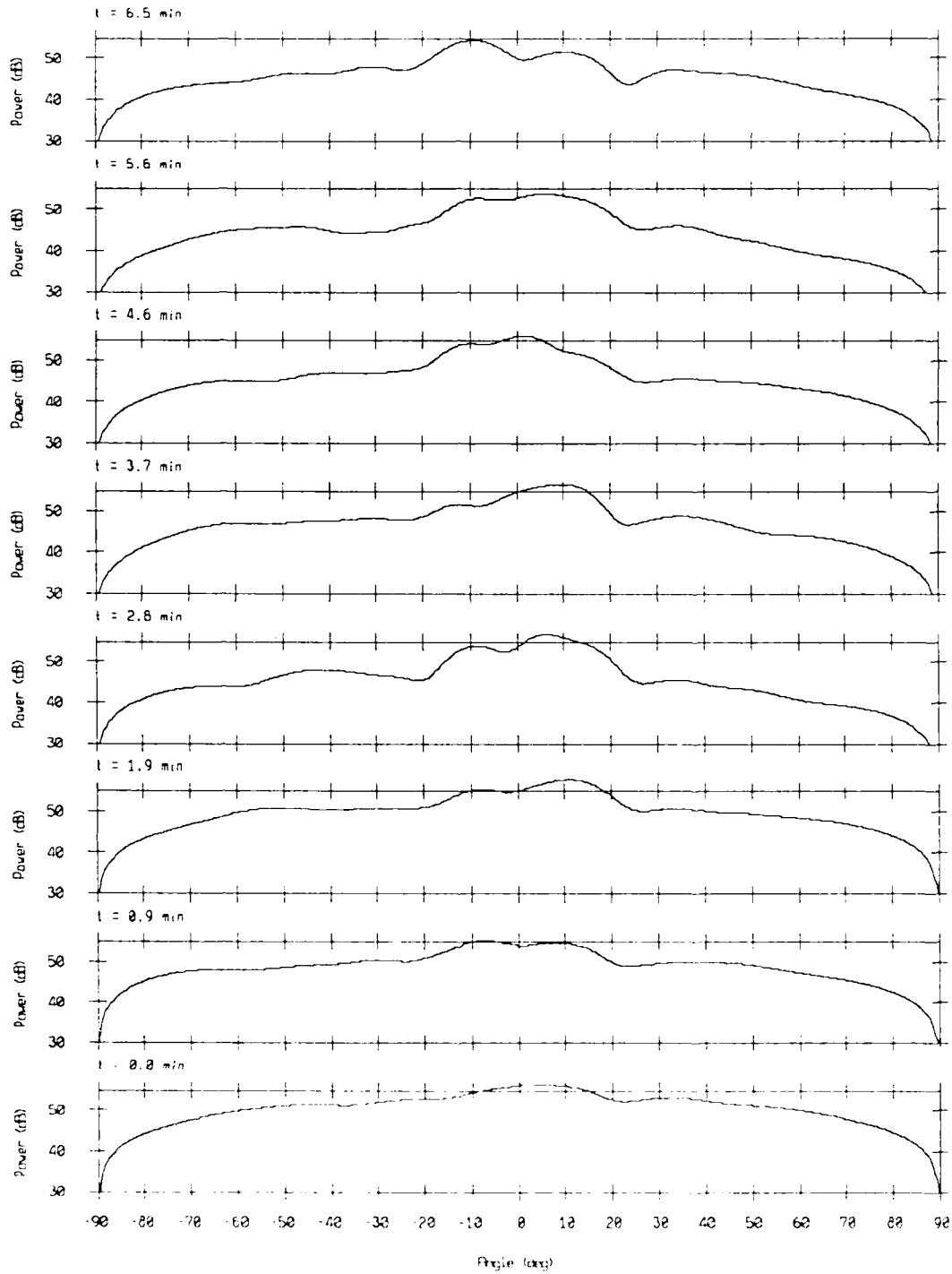


Array Response - 85060 Bin #4793

$f = 100$ Hz, KB window ($\alpha = 1.5$)

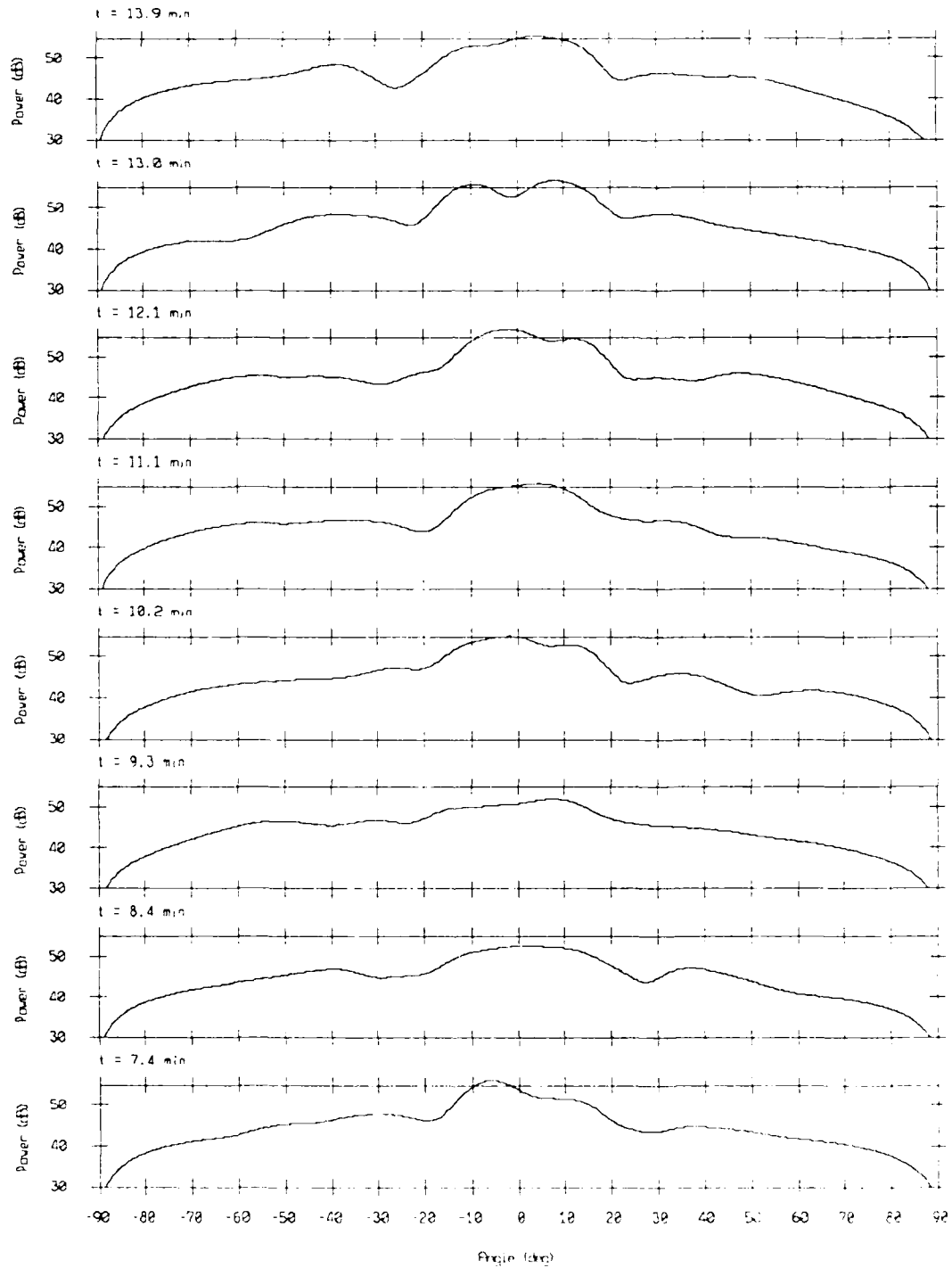


$f = 125 \text{ Hz}$, KB window ($\alpha = 1.5$)



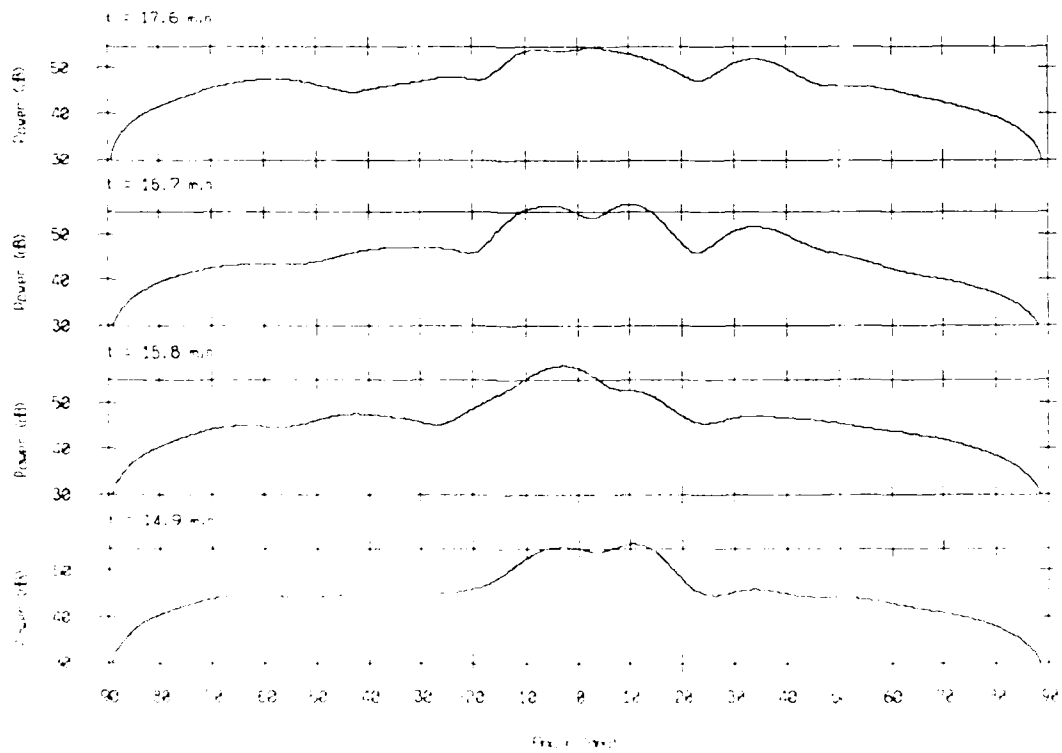
Array Response - 86000 Bin #4967

$f = 125$ Hz, KB window ($\alpha = 1.5$)



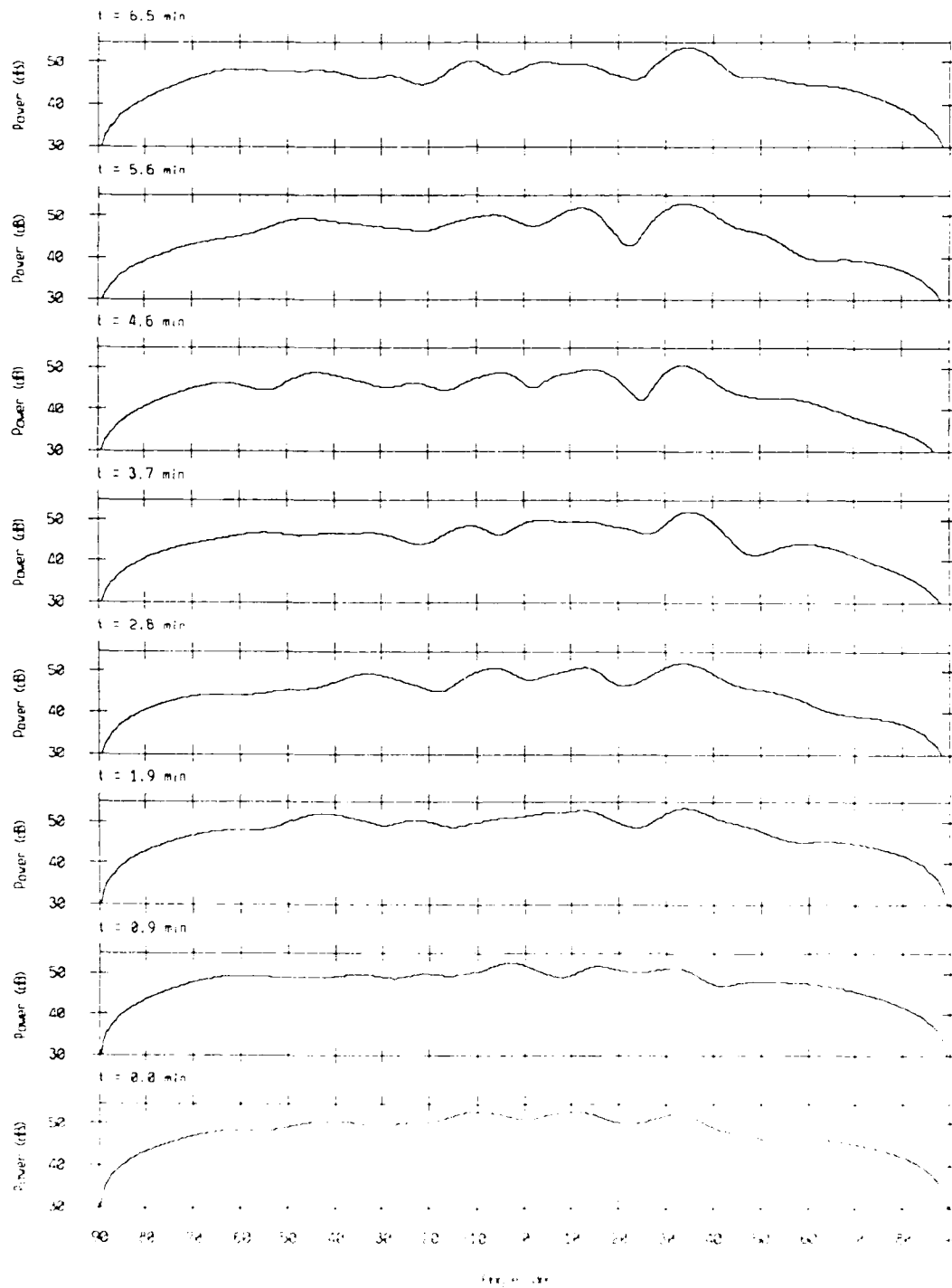
Array Response - 86260 Bin #4967

$f = 125$ Hz, K5 window ($\alpha = 1.5$)



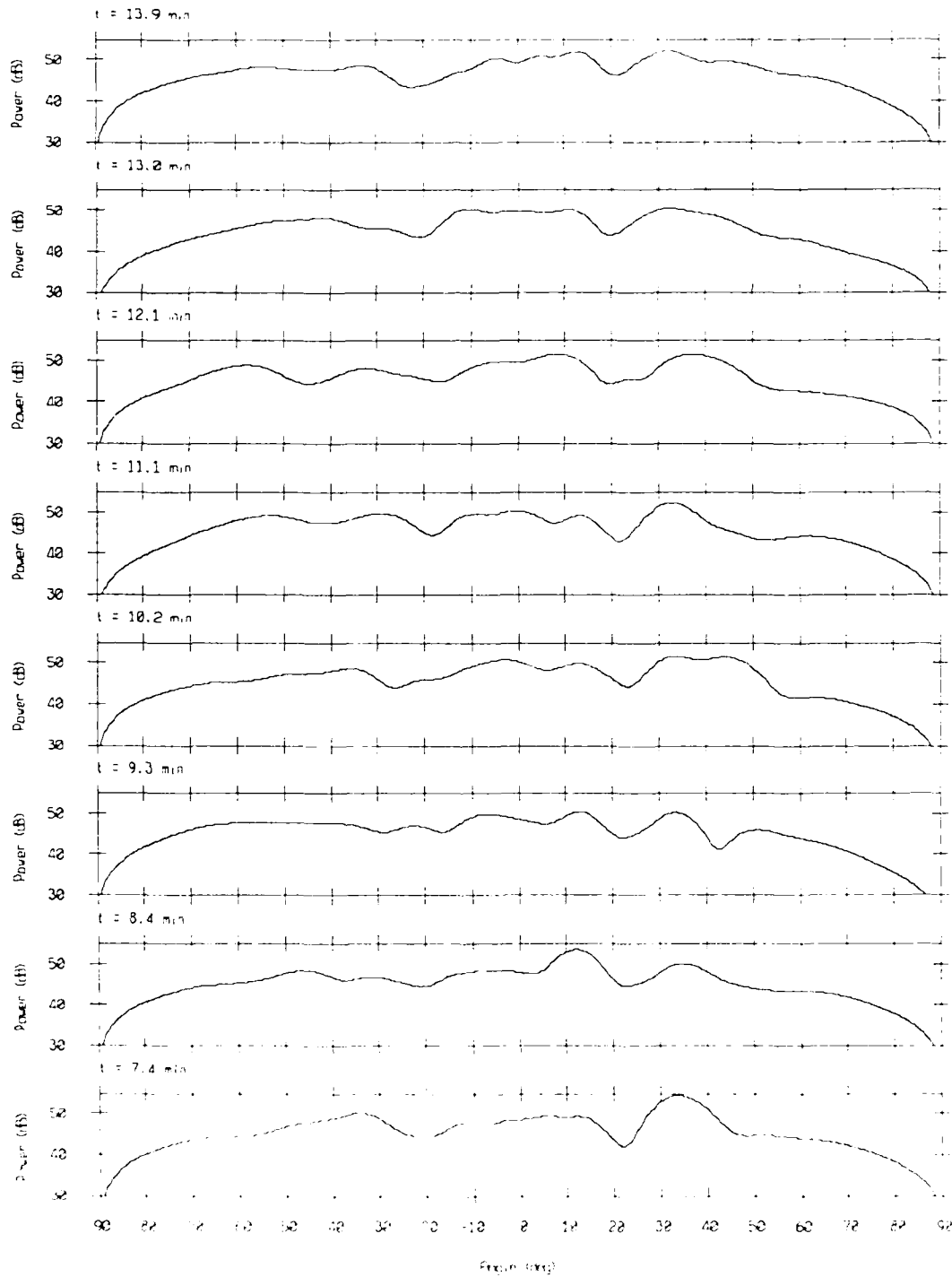
Array Response - 86062 Bin #5141

$f = 150$ Hz, KB window ($\alpha = 1.5$)



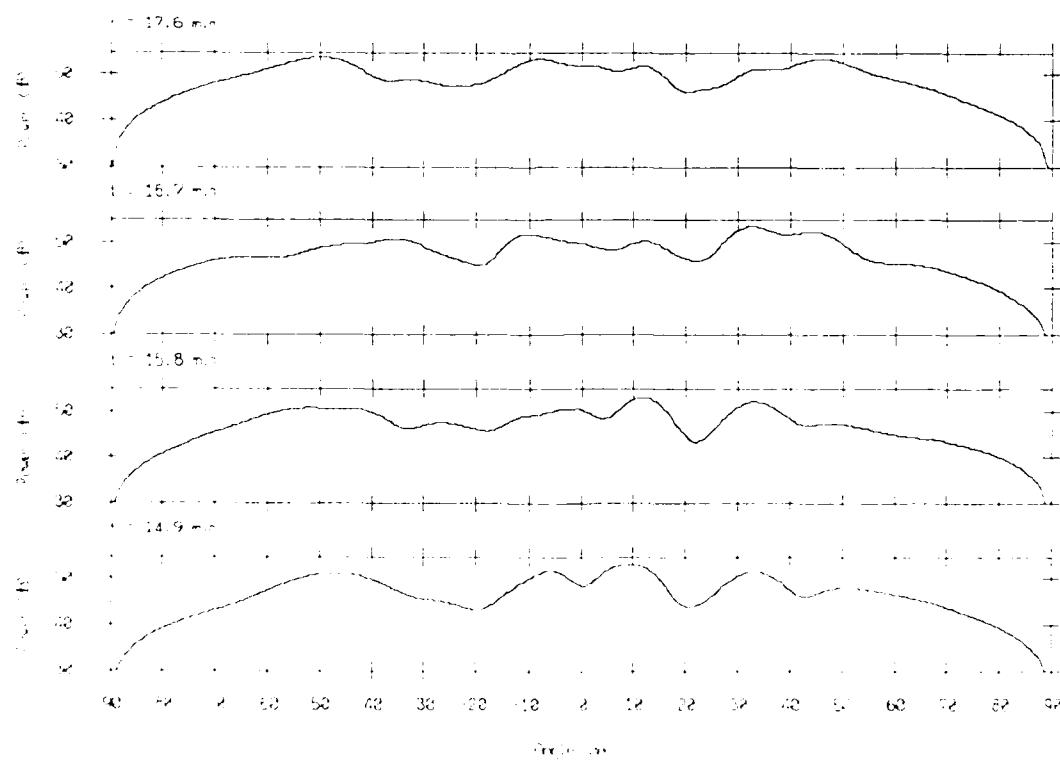
Array Response - 86060 Bin #5141

$f = 150$ Hz, K5 window ($\alpha = 1.5$)



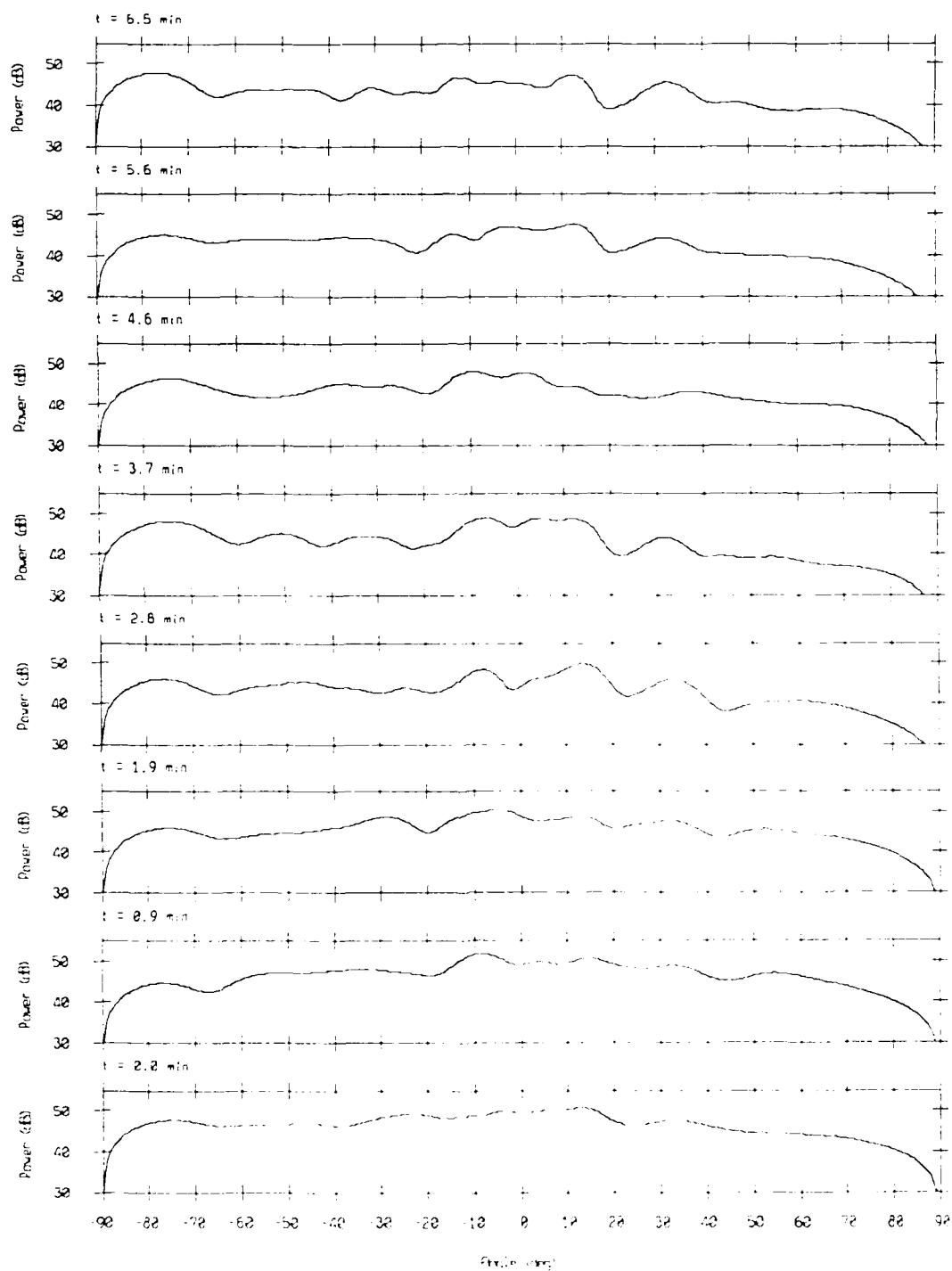
Pinney Response - 86060 Bin #6141

$f = 152$ Hz, $\Delta 3$ window ($\alpha = 1.5$)



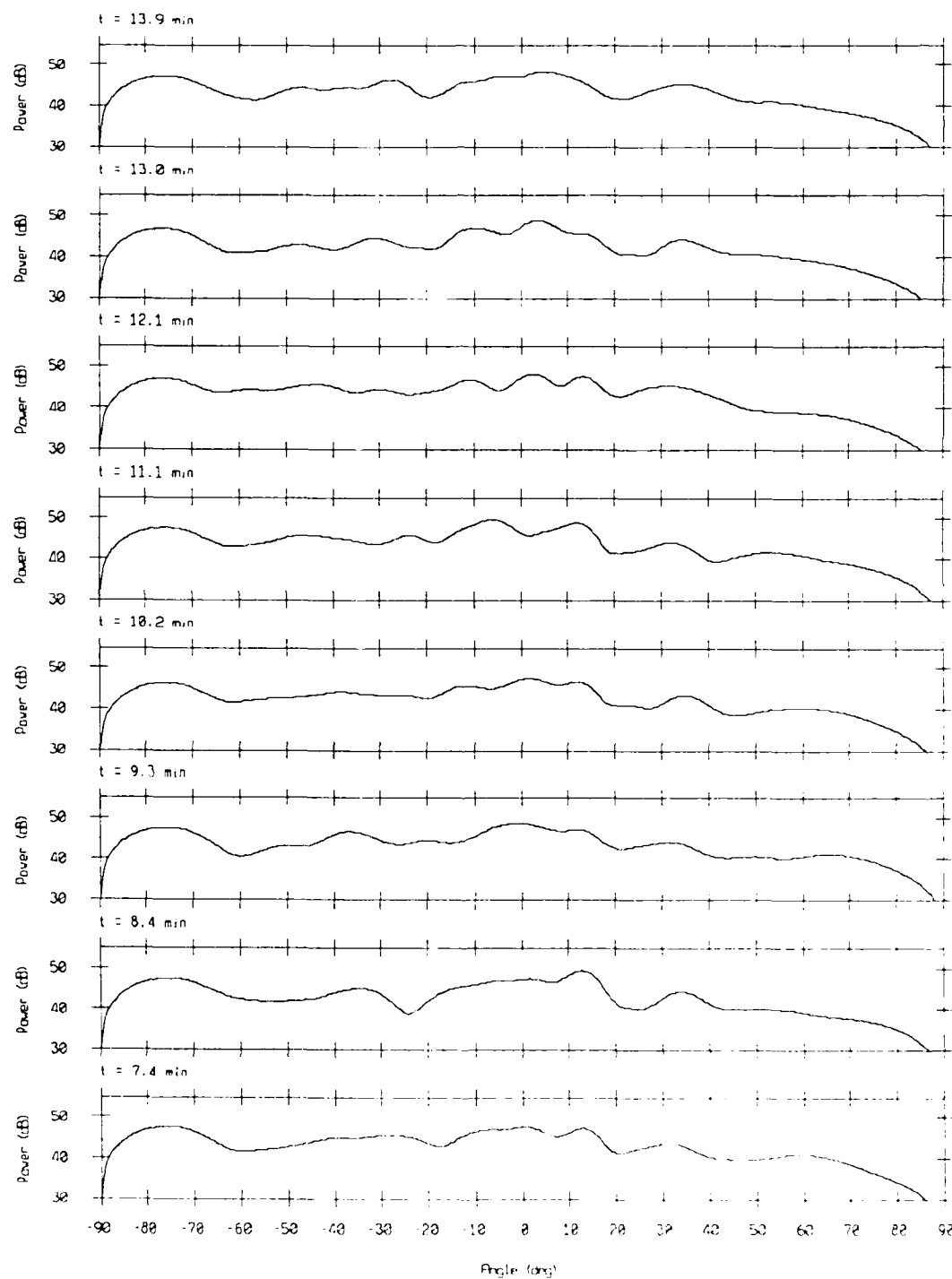
Array Response - 86260 Bin #5316

$f = 175$ Hz, KB window ($\alpha = 1.5$)



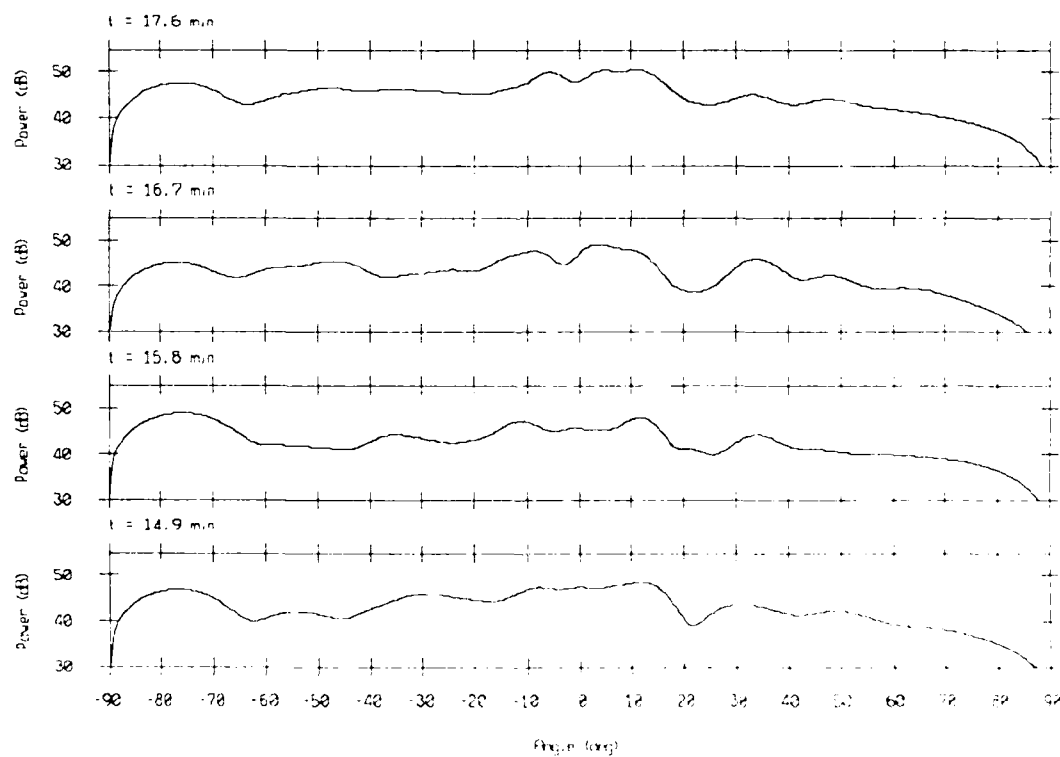
Array Response - 85060 Bin #5316

$f = 175$ Hz, KB window ($\alpha = 1.5$)



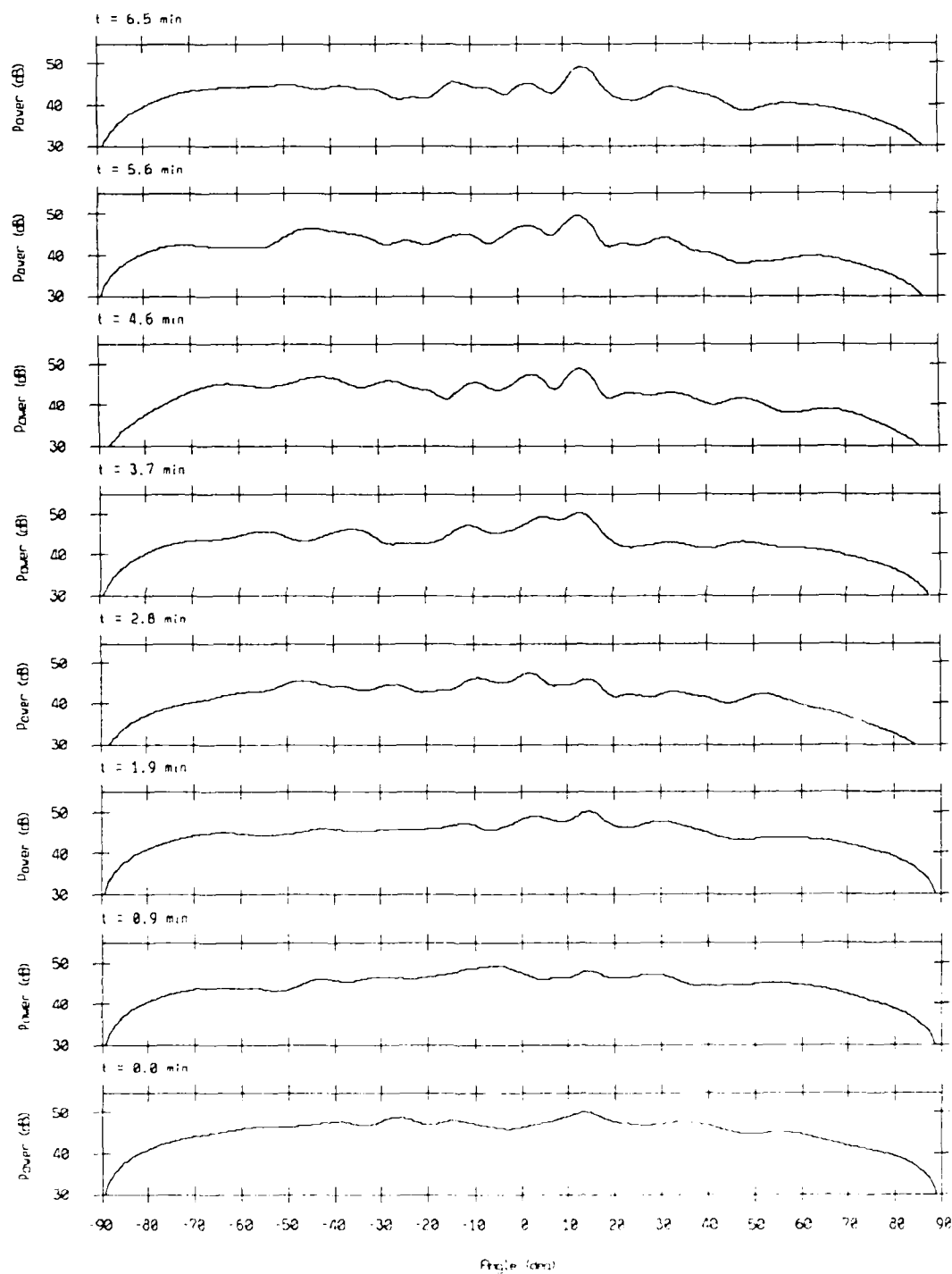
Array Response - 86060 Bin #5316

$f = 175$ Hz, KB window ($\alpha = 1.5$)



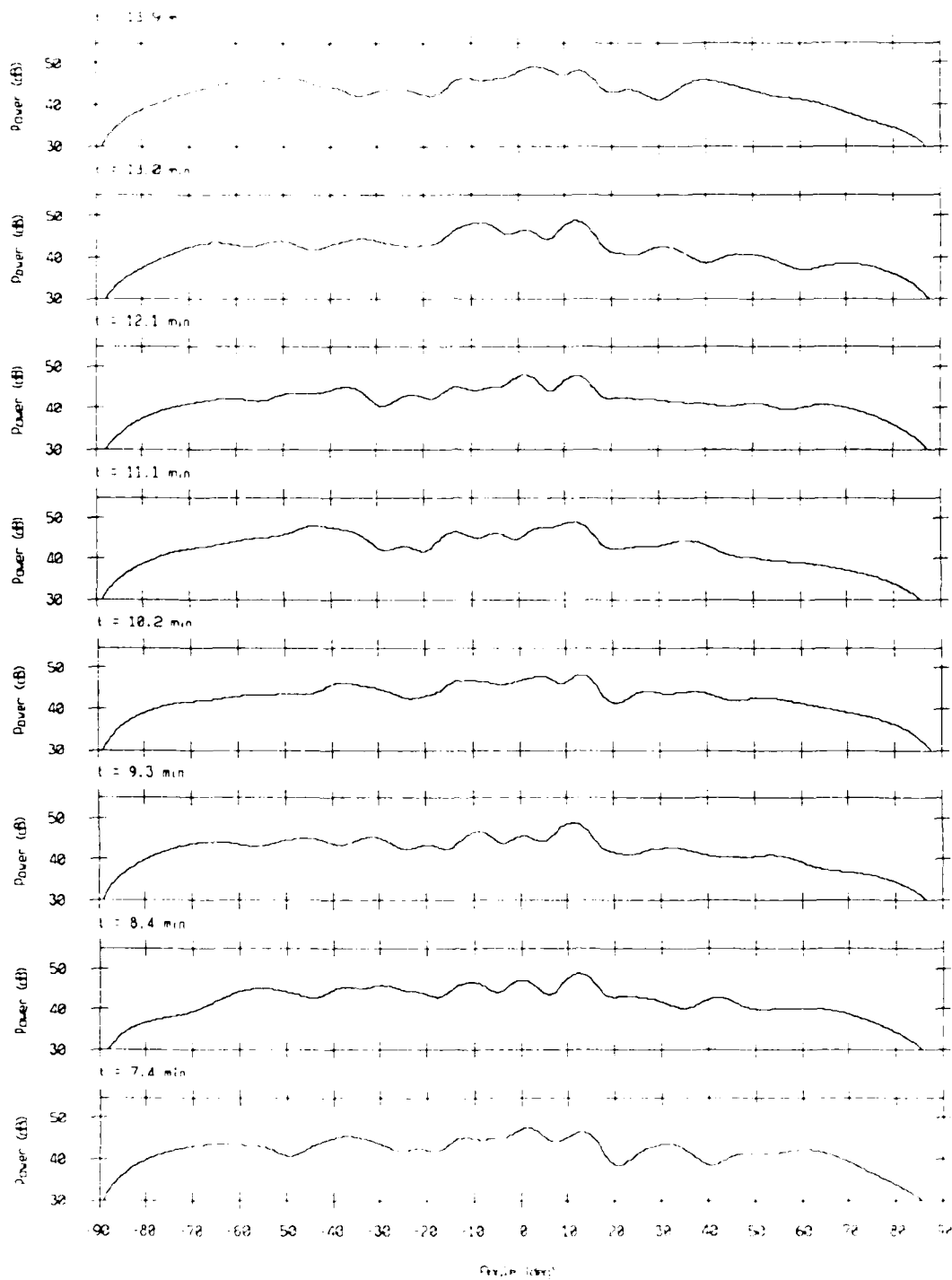
Array Response - 86060 Bin #5490

$f = 200$ Hz, KB window ($\alpha = 1.5$)



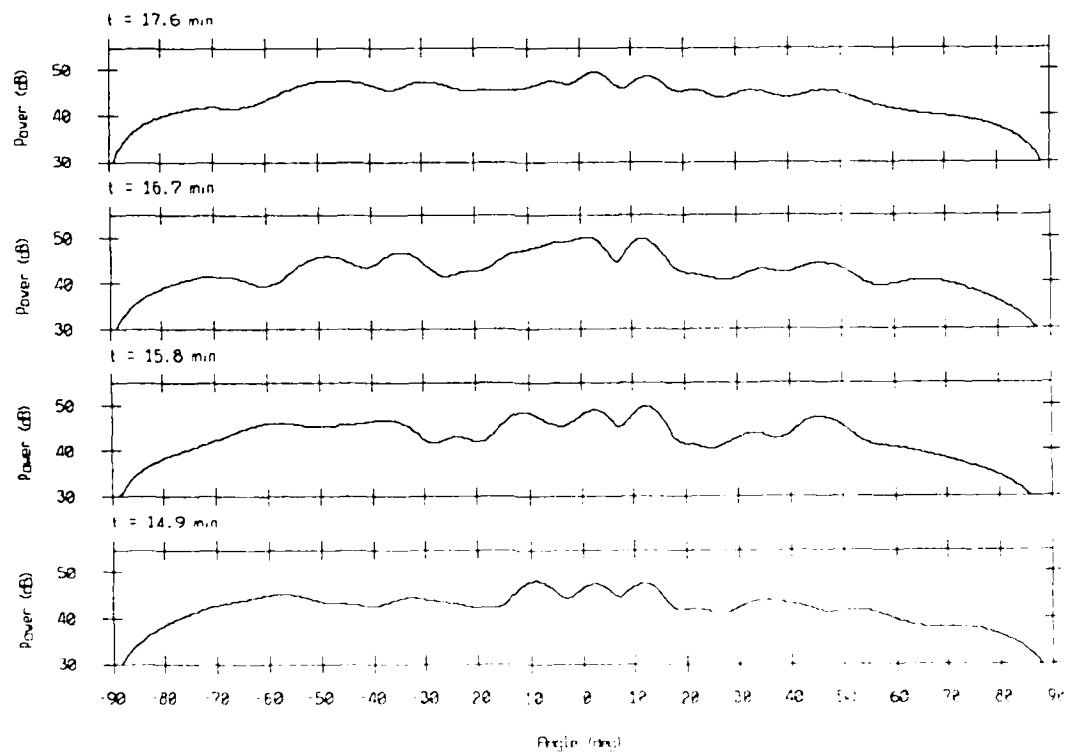
Brady Resistor 88000 B1r #5490

$f = 220 \text{ Hz}$, 45 window (slope = 1.5)



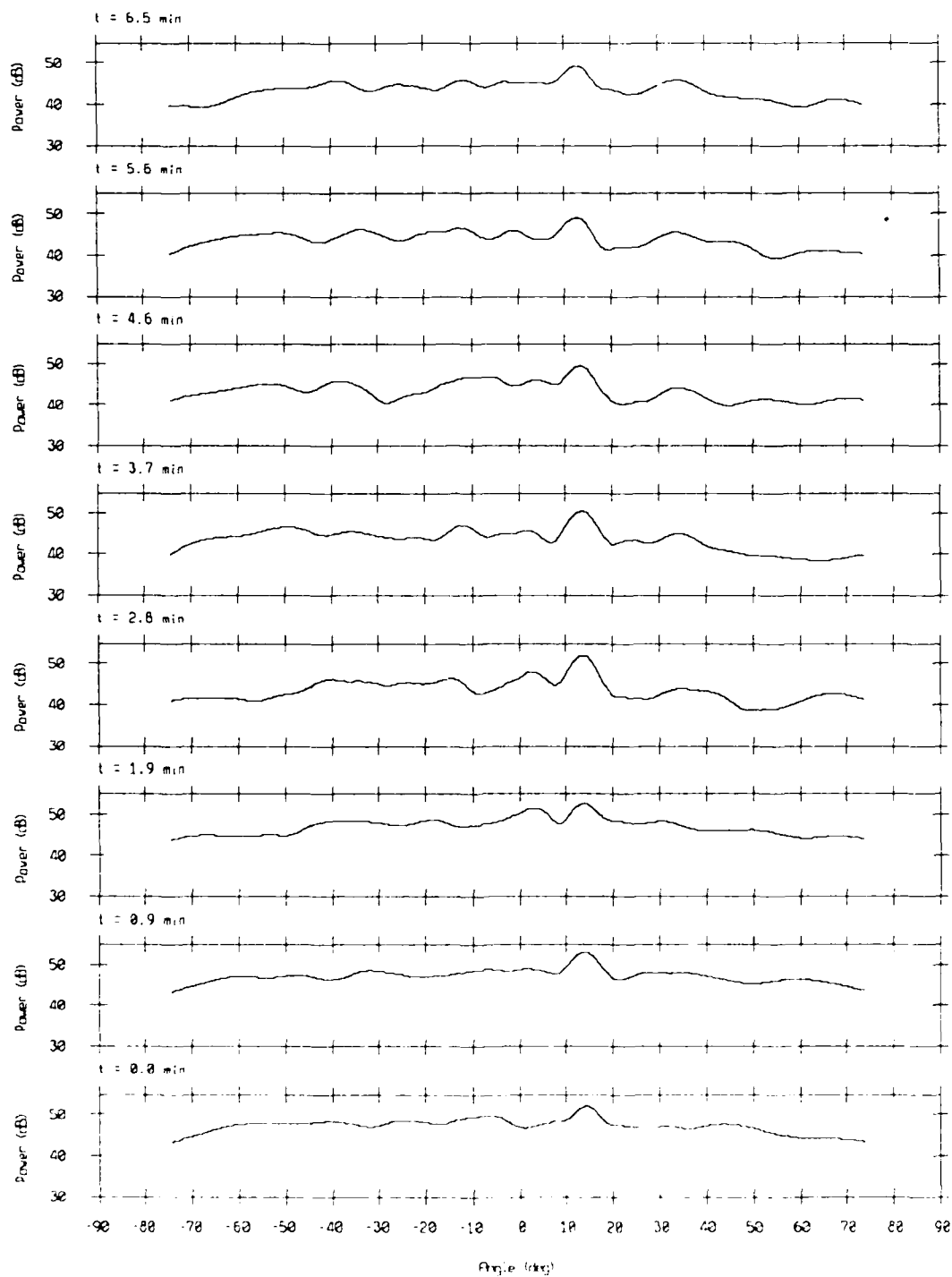
Array Response - 86060 Bin #5490

$f = 200$ Hz, KB window ($\alpha = 1.5$)



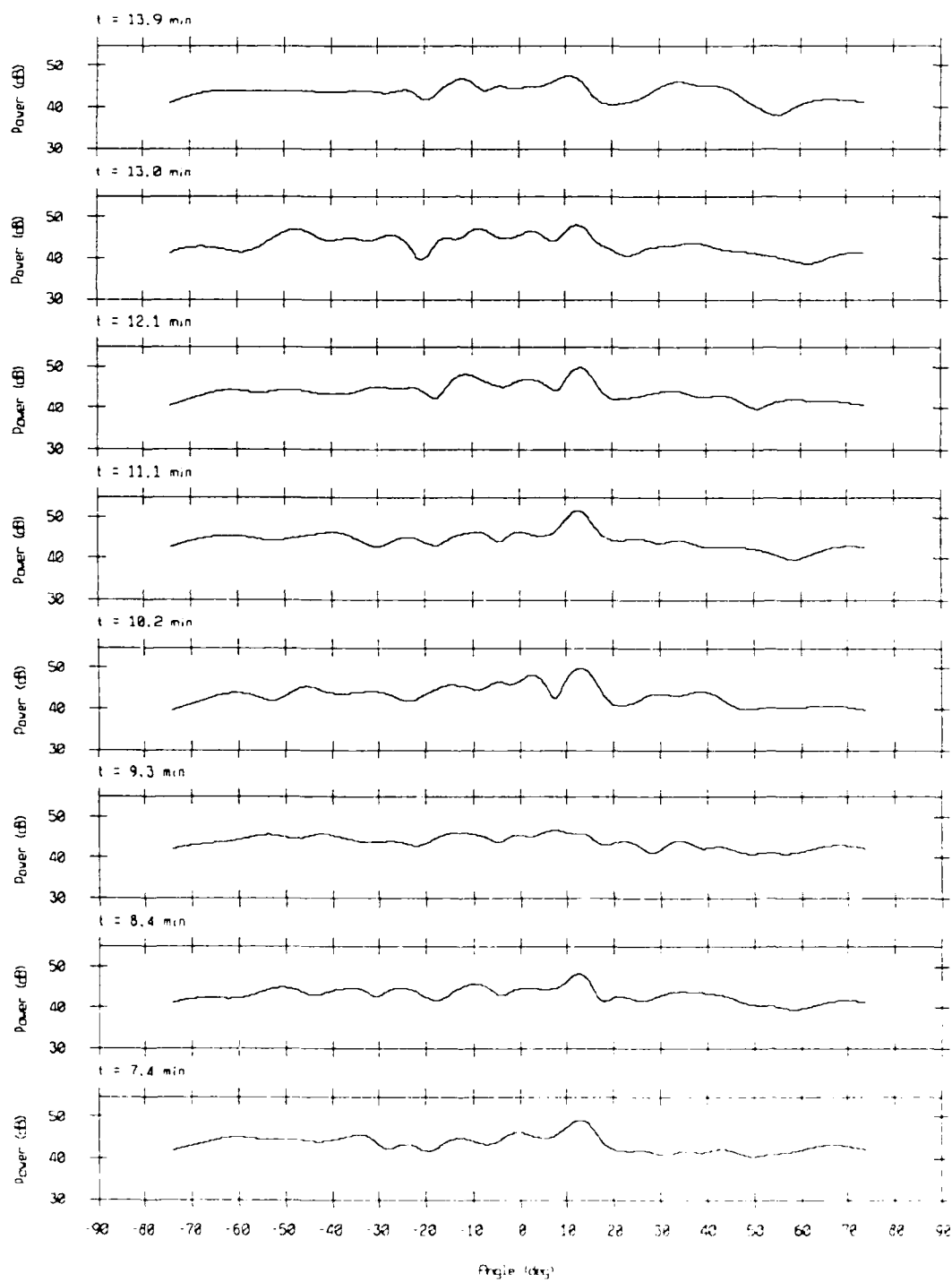
Array Response - 86060 Bin #5664

$f = 225$ Hz, KB window ($\alpha = 1.5$)



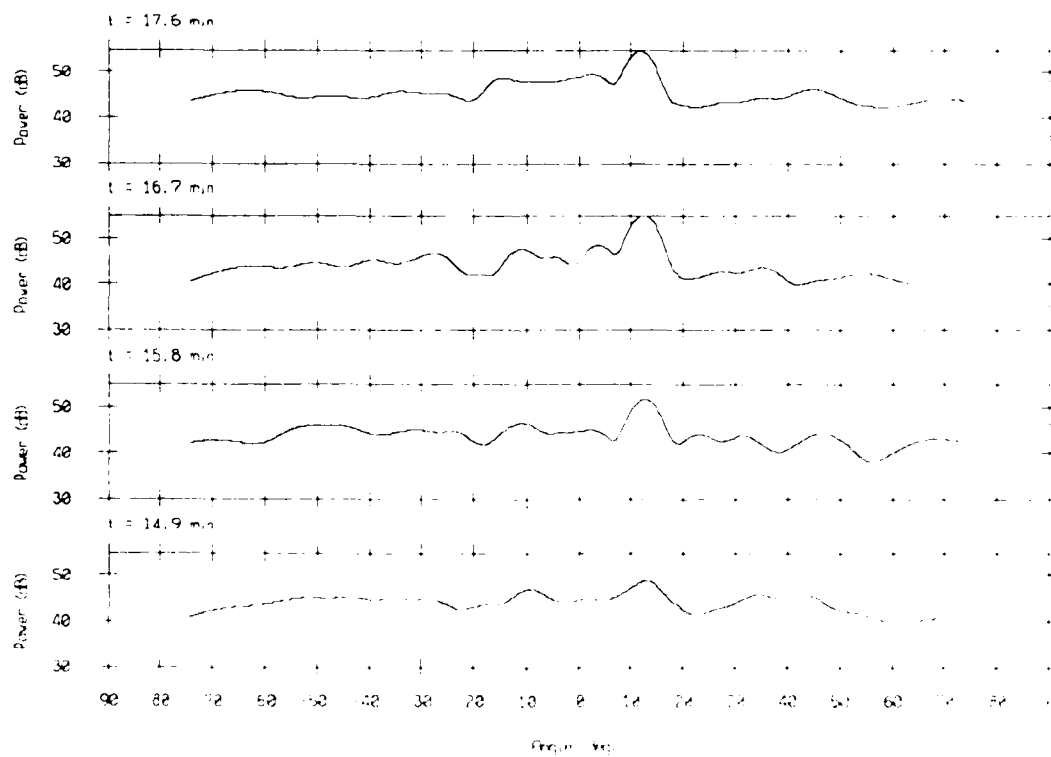
Array Response - 86060 Bin #5664

$f = 225$ Hz, KB window ($\alpha = 1.5$)



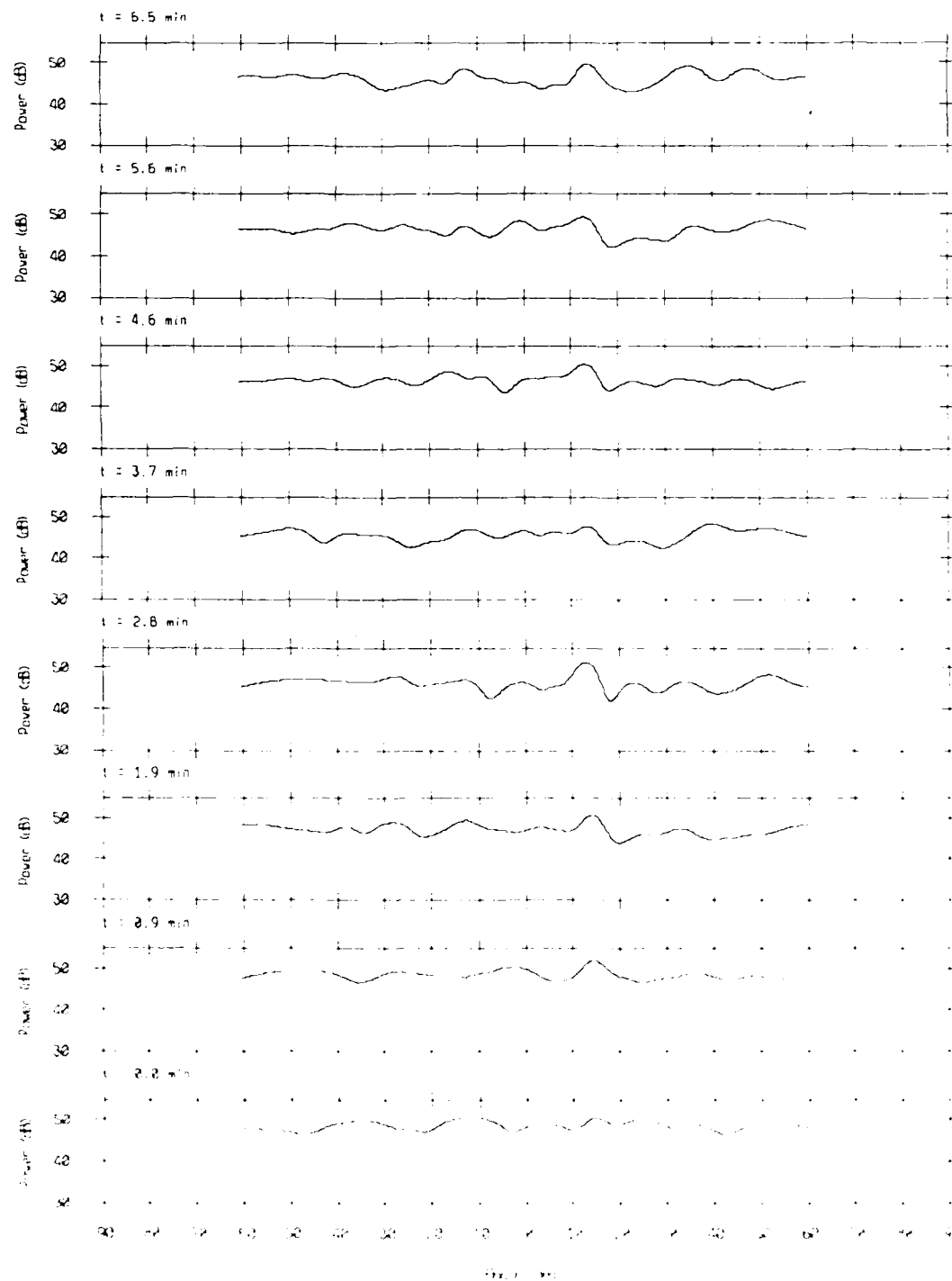
Array Response - 85060 Bin #5664

$f = 225$ Hz, KB window ($\alpha = 1.5$)



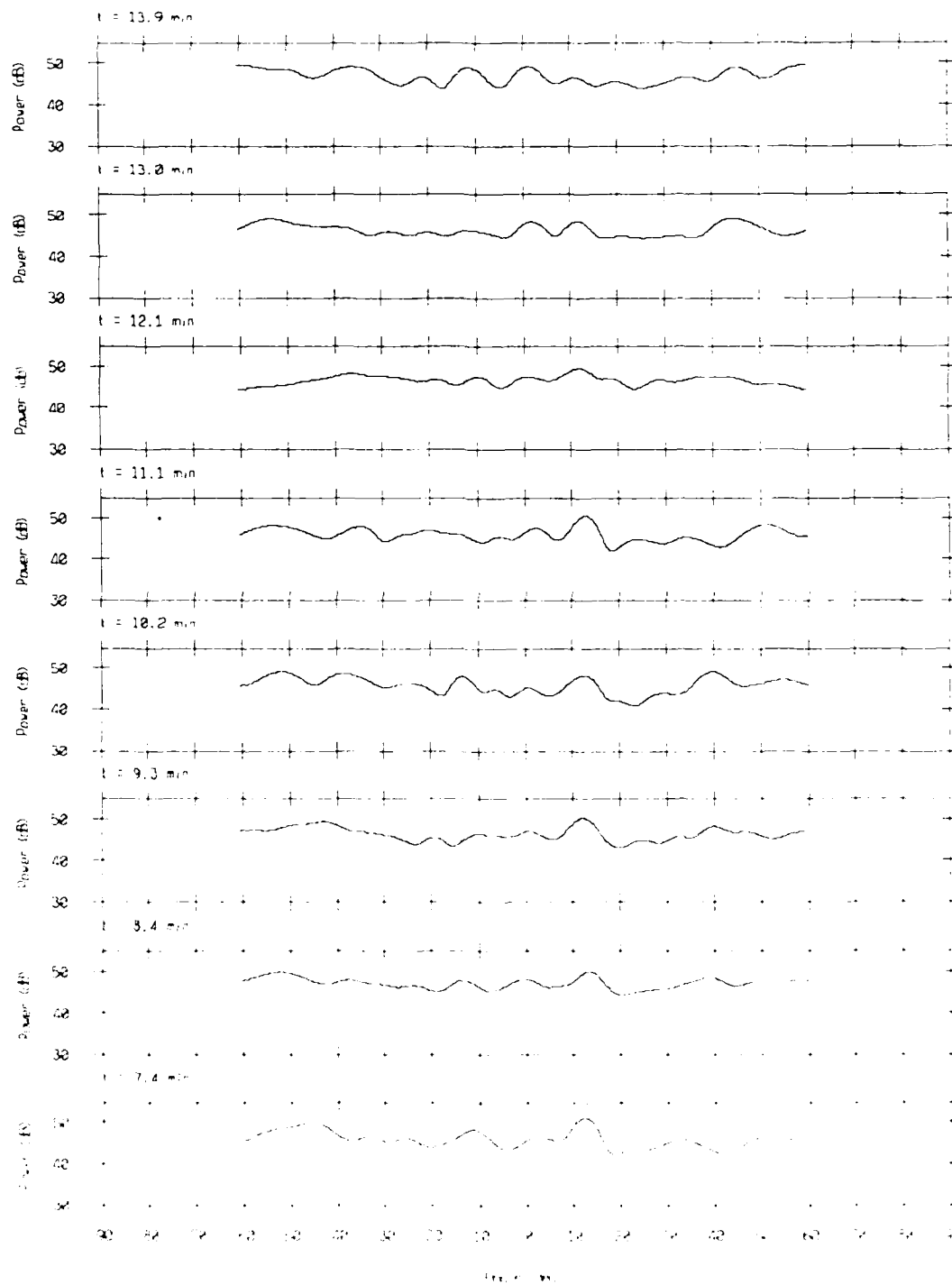
Array Response - 86060 Bin #5832

$f = 250$ Hz, KB window ($\alpha = 1.5$)



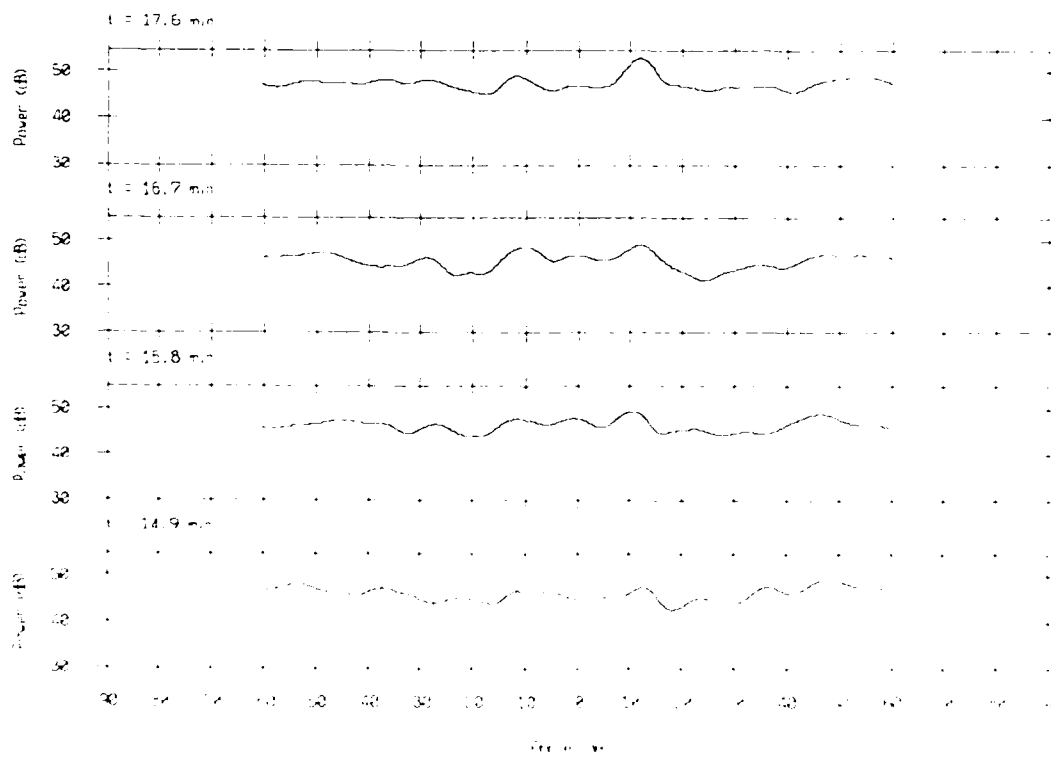
Array Response - 86060 3in #5832

$f = 250$ Hz, KB window ($\alpha_{\text{pnc}} = 1.5$)



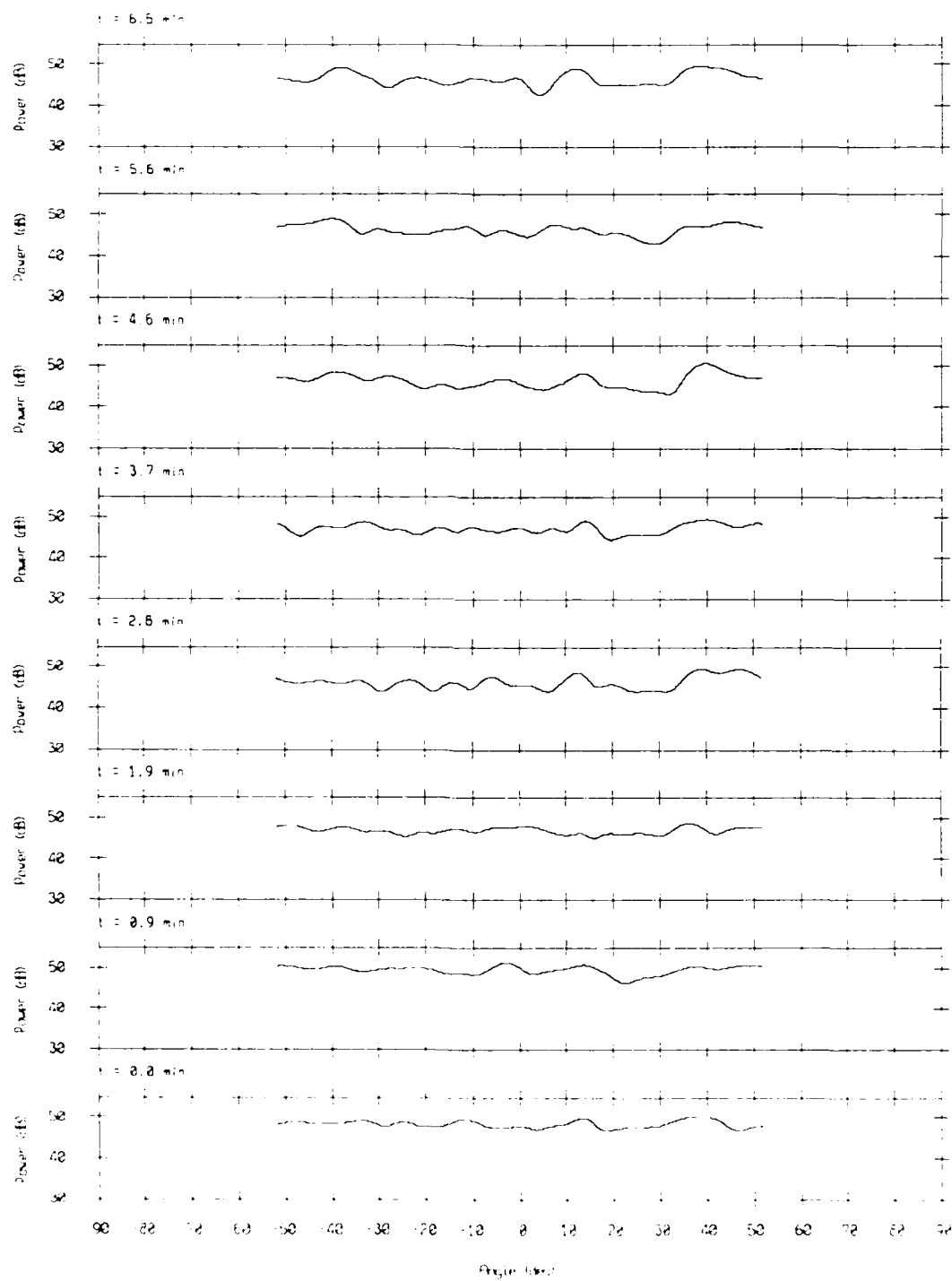
Array Response - 86060 Bin #5832

$f = 250$ Hz, K3 window (α pha = 1.5)



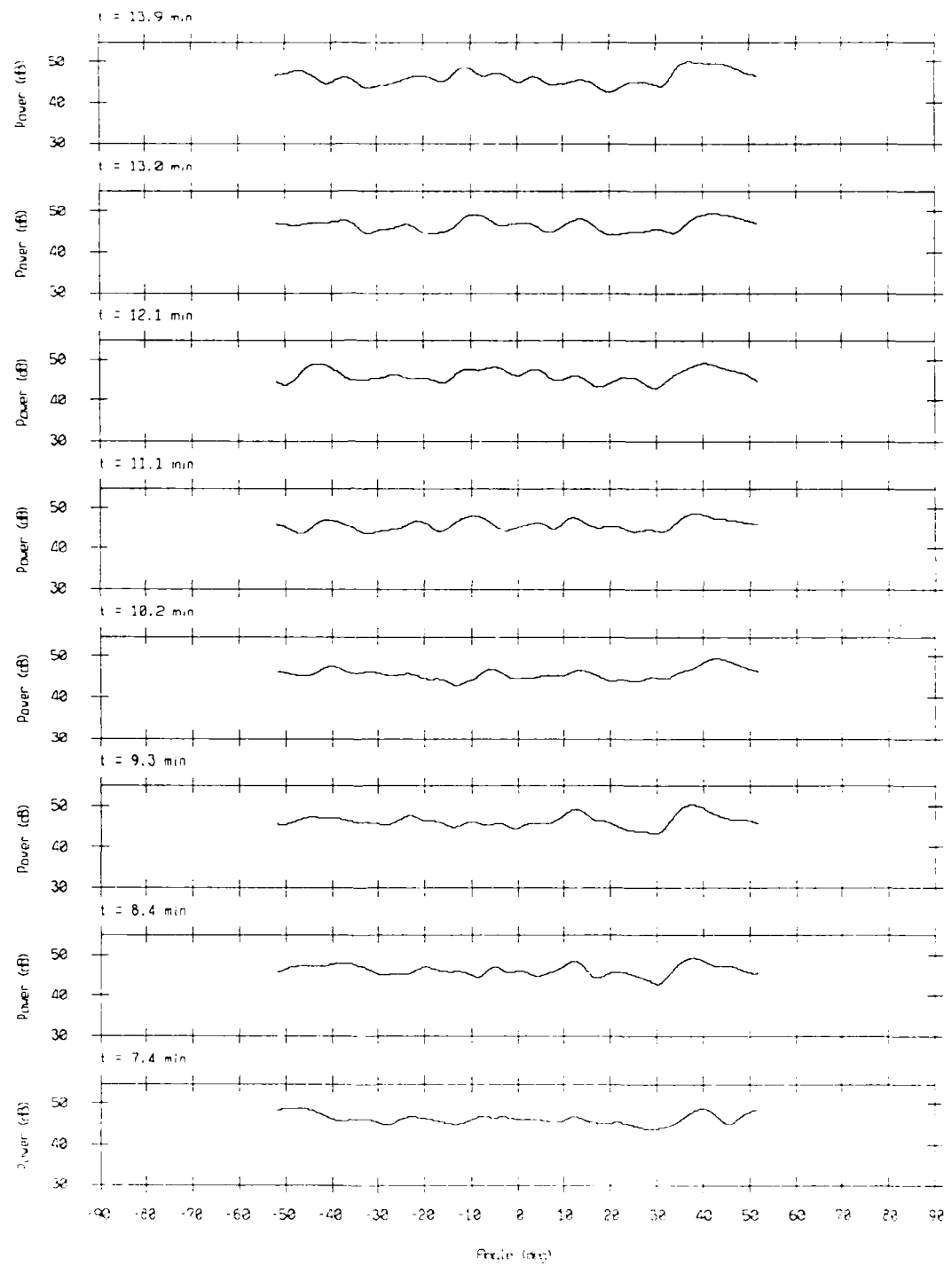
Array Response - 85262 Bin #6012

$f = 275$ Hz, KB window ($\alpha = 1.5$)



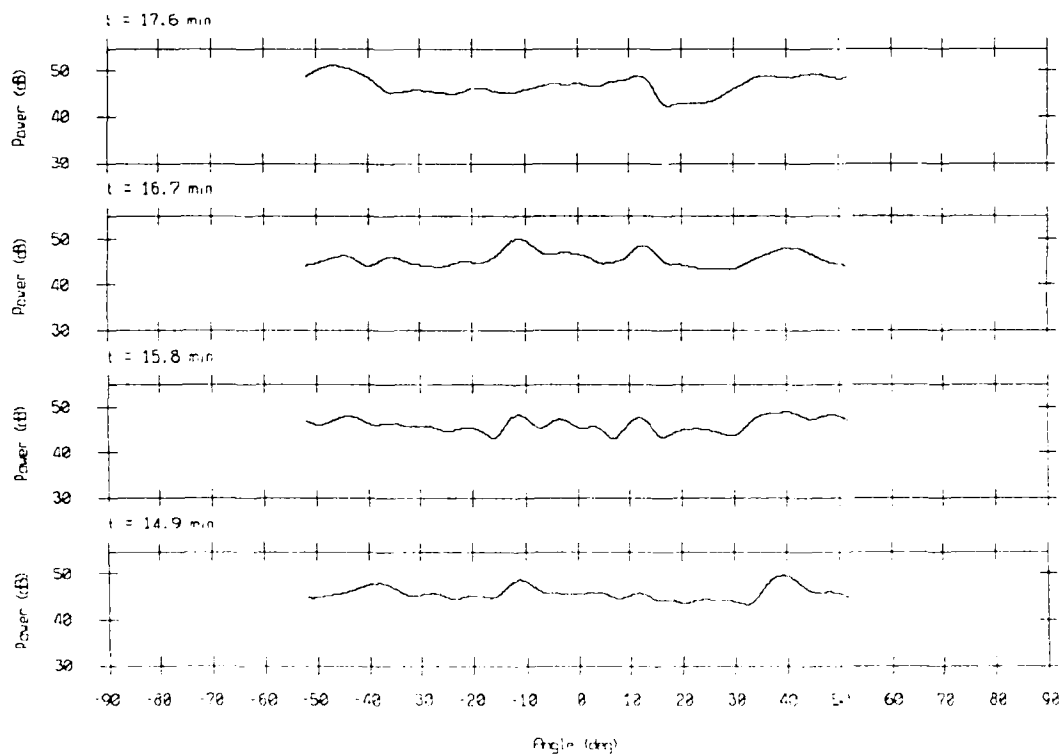
Array Response - 86060 Bin #6012

$f = 275$ Hz, KB window ($\alpha = 1.5$)



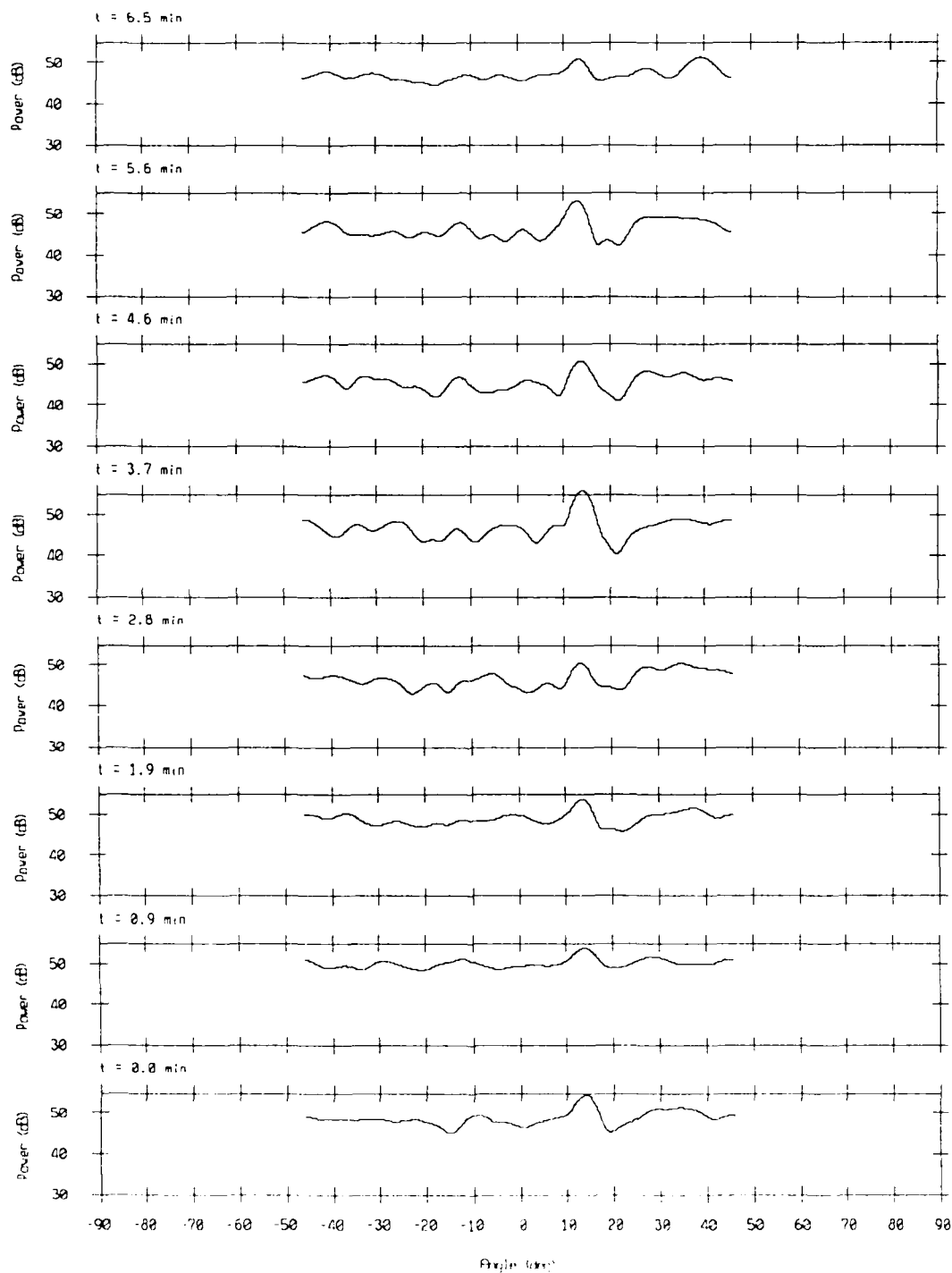
Array Response - 86060 Bin #6012

$f = 275$ Hz, KB window ($\alpha = 1.5$)



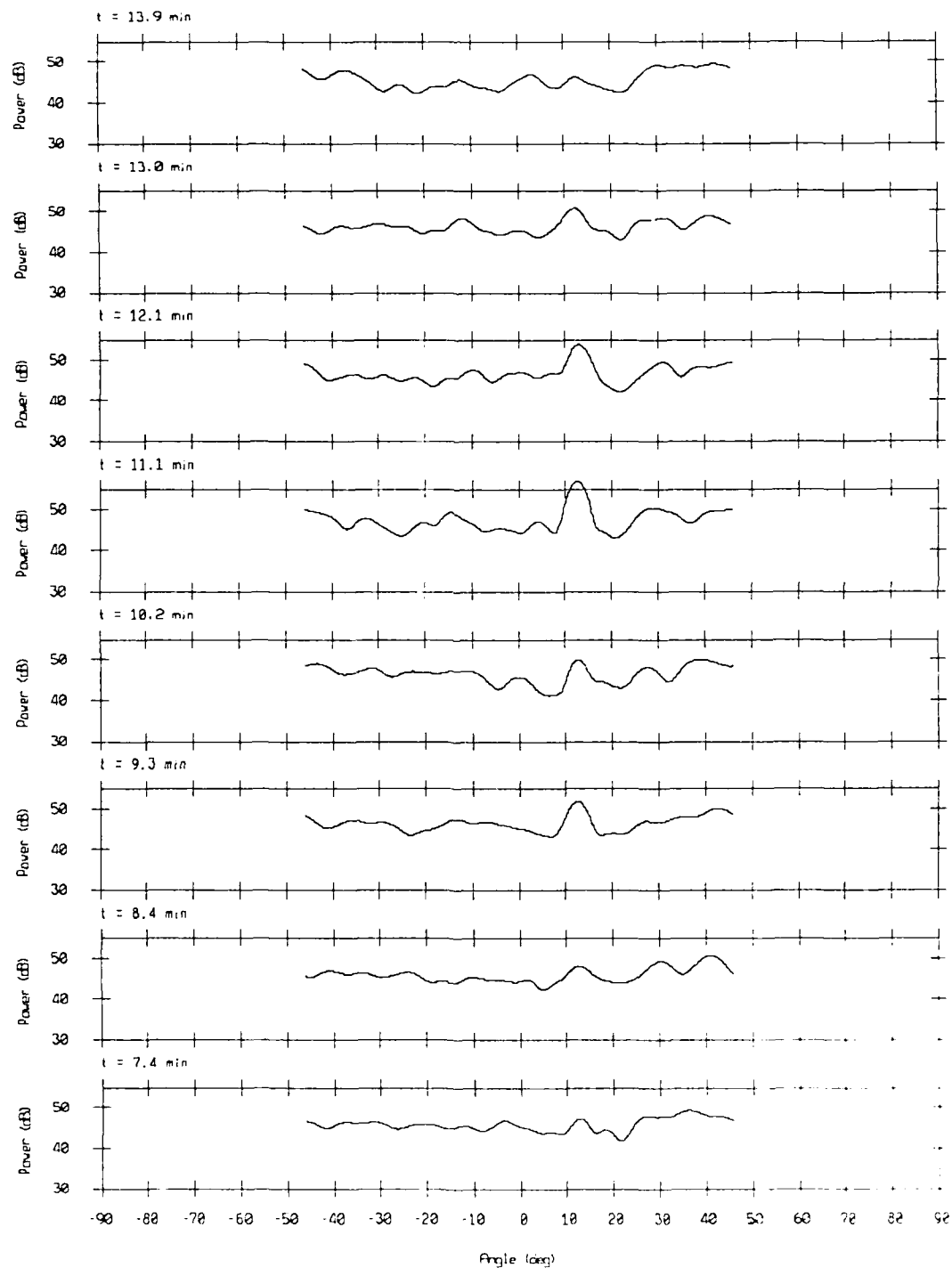
Array Response - 86060 Bin #6186

$f = 300$ Hz, KB window ($\alpha = 1.5$)



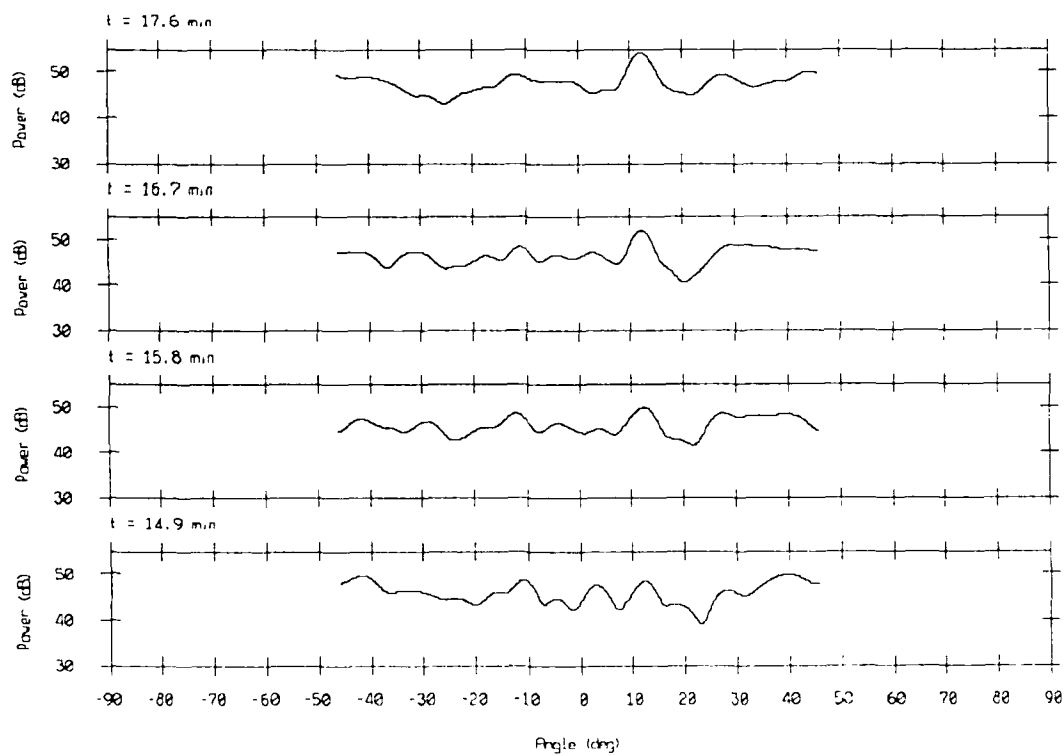
Array Response - 86060 Bin #6186

$f = 300$ Hz, KB window ($\alpha = 1.5$)



Array Response - 86060 Bin #6186

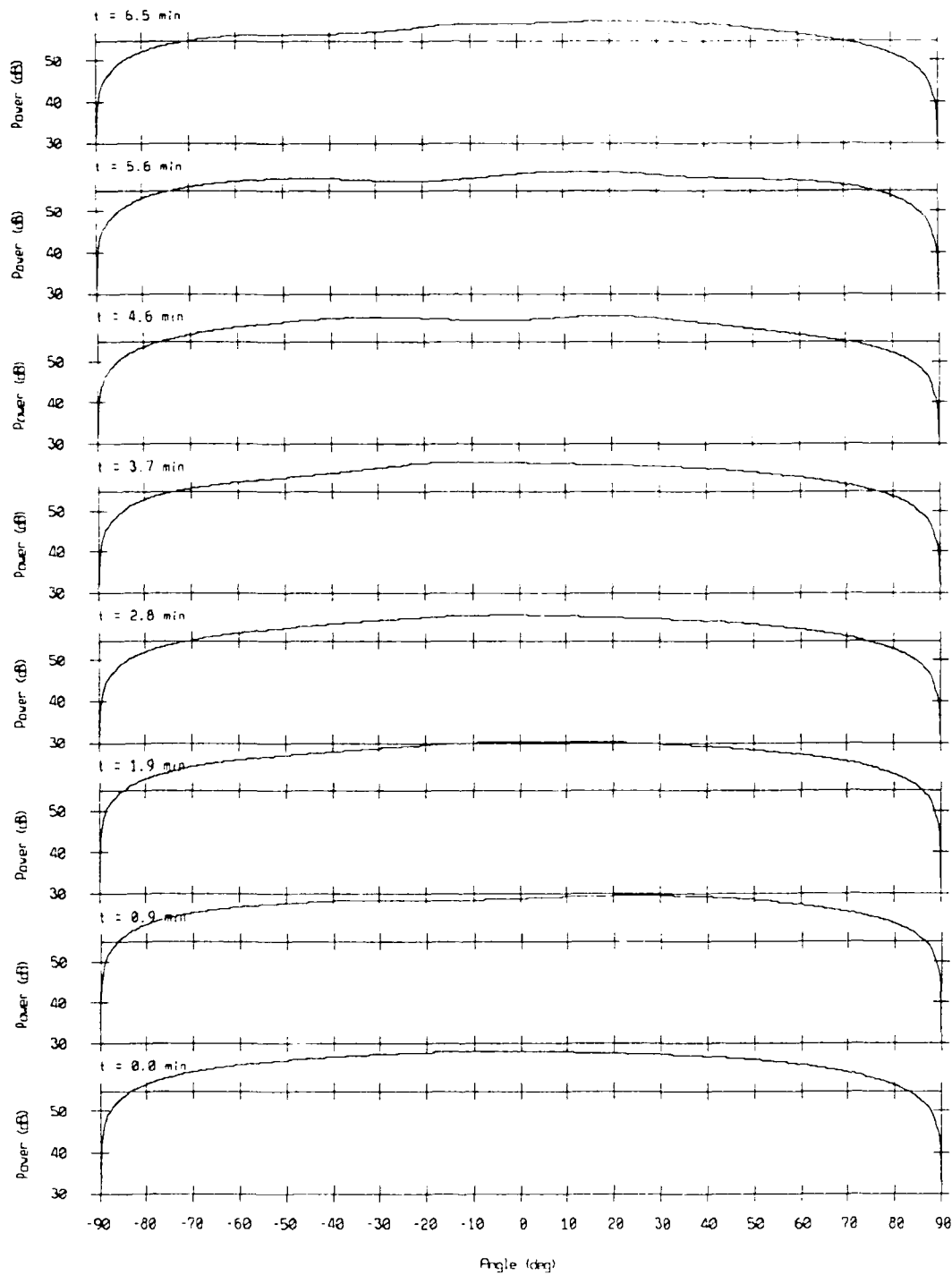
$f = 300$ Hz, KB window ($\alpha = 1.5$)



VII. Array Response: Panels, Rect Window.

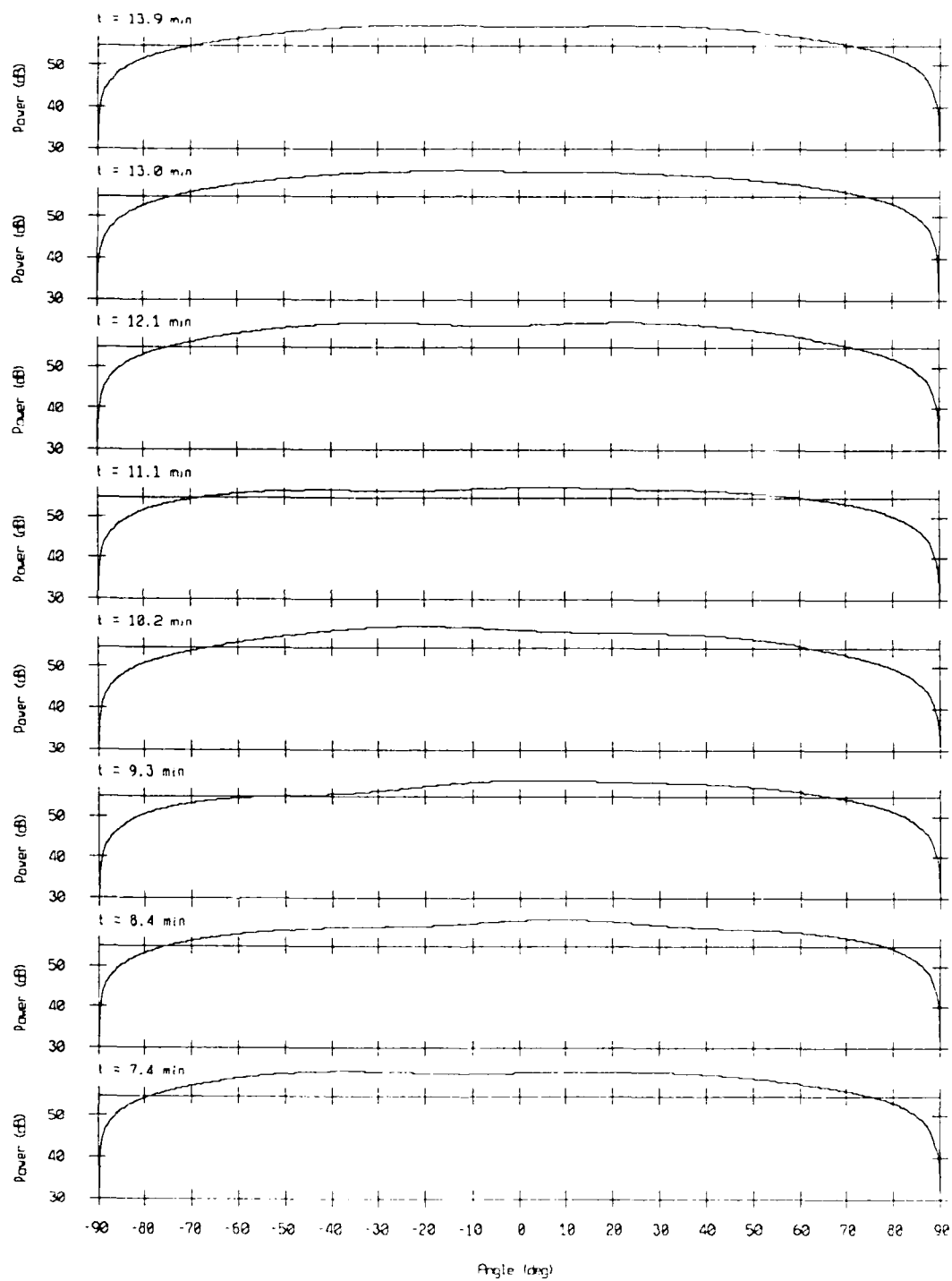
Array Response - 86060 Bin #4271

$f = 25$ Hz, rect window



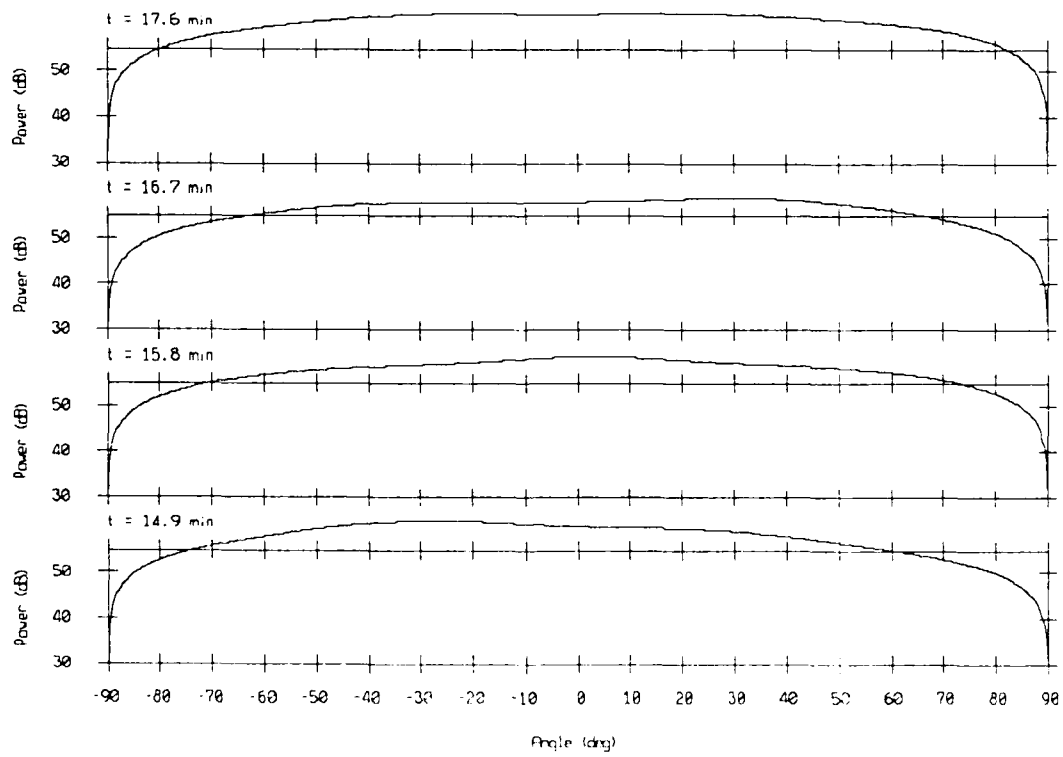
Array Response - 86060 Bin #4271

$f = 25$ Hz, rect window



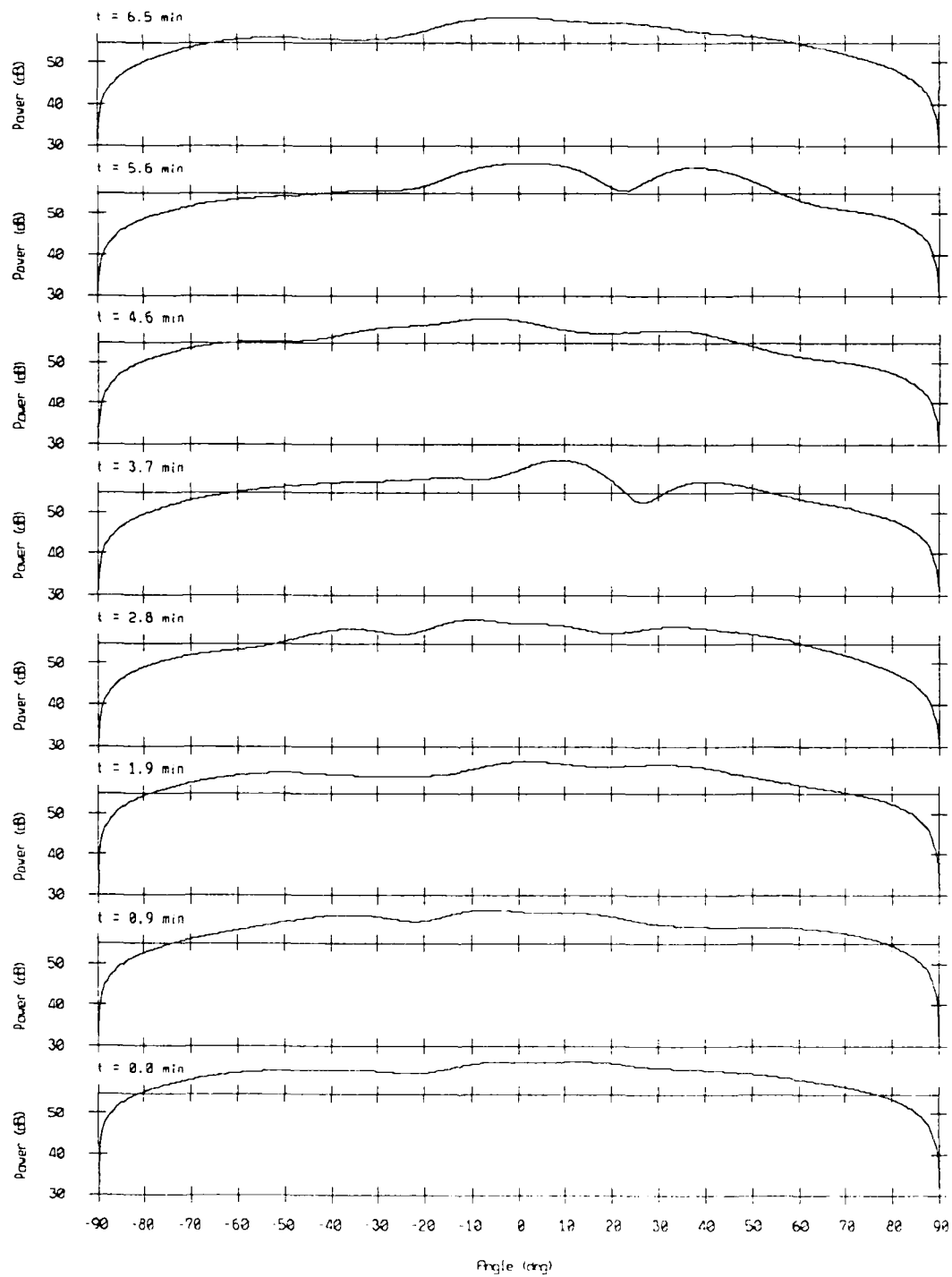
Array Response - 86060 Bin #4271

$f = 25$ Hz, rect window



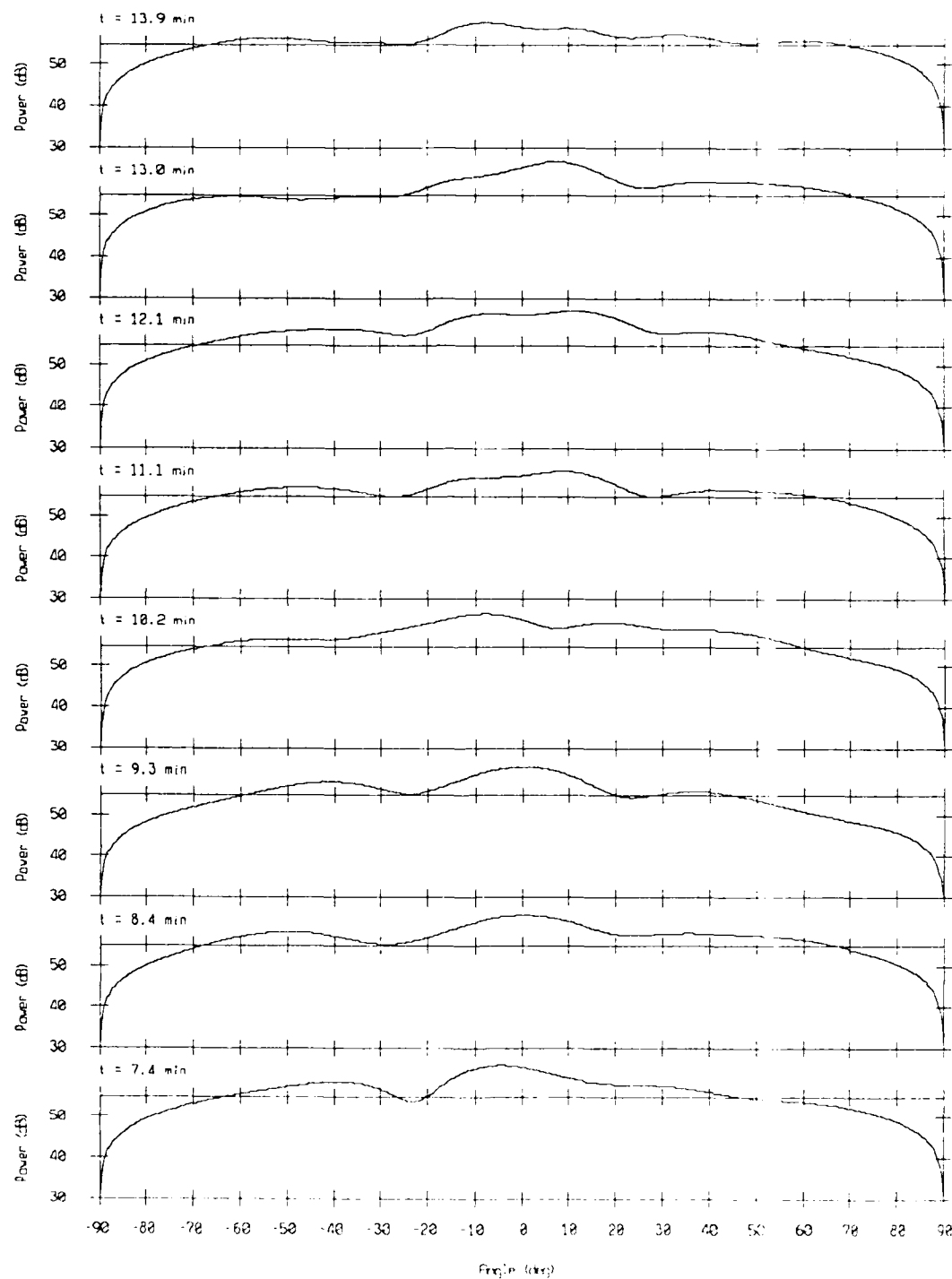
Array Response - 86060 Bin #4445

$f = 50$ Hz, rect window



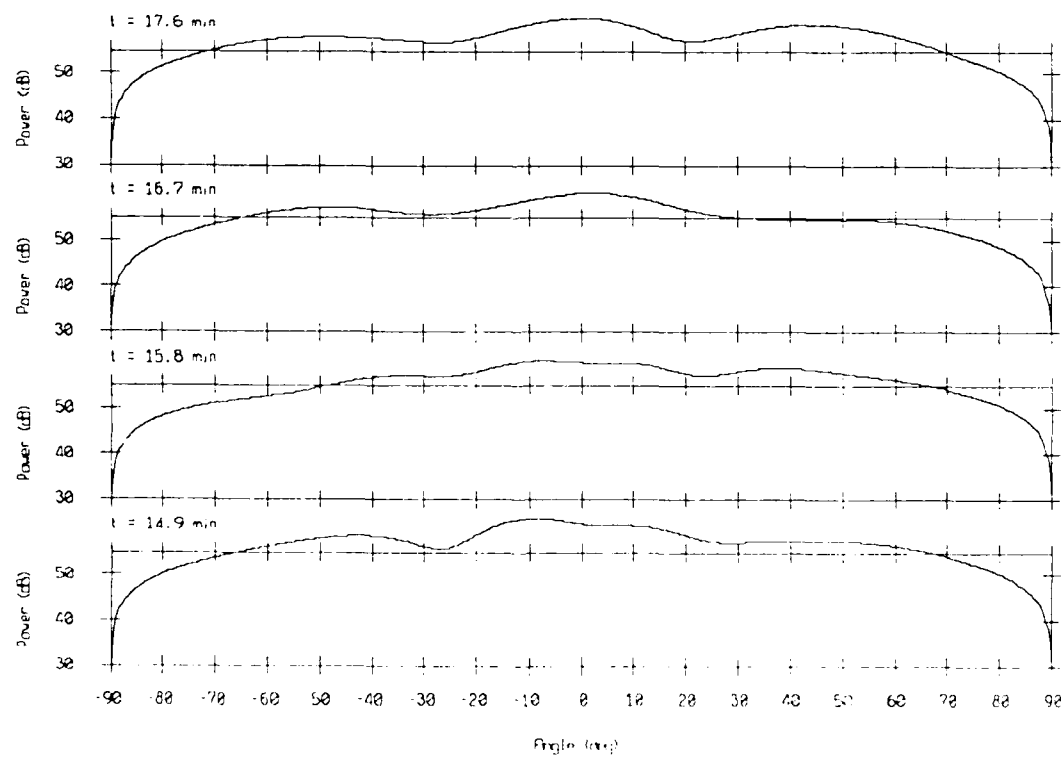
Array Response - 86060 Bin #4445

$f = 50$ Hz, rect window



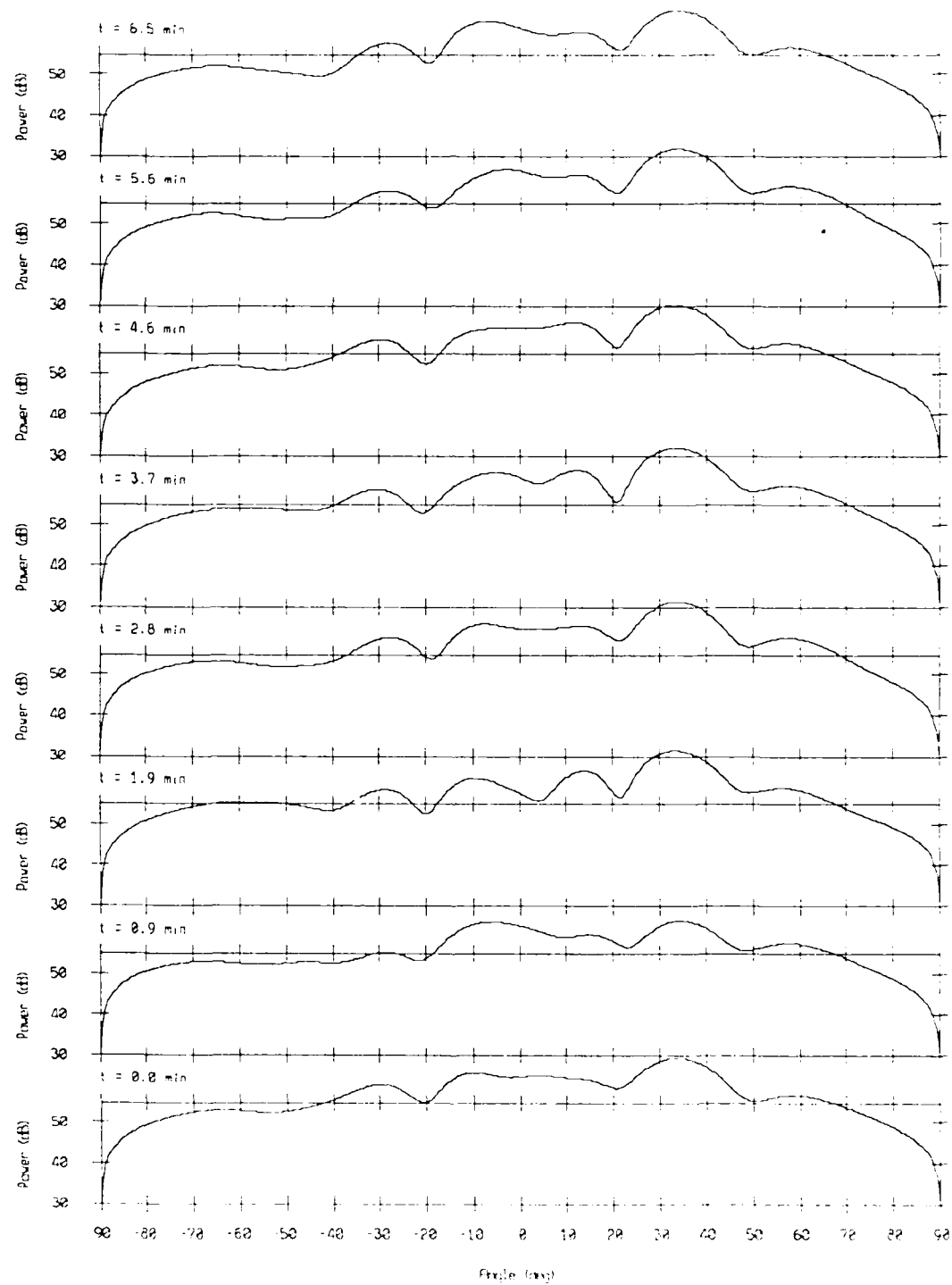
Array Response - 86260 Bin #4445

$f = 50$ Hz, rect window



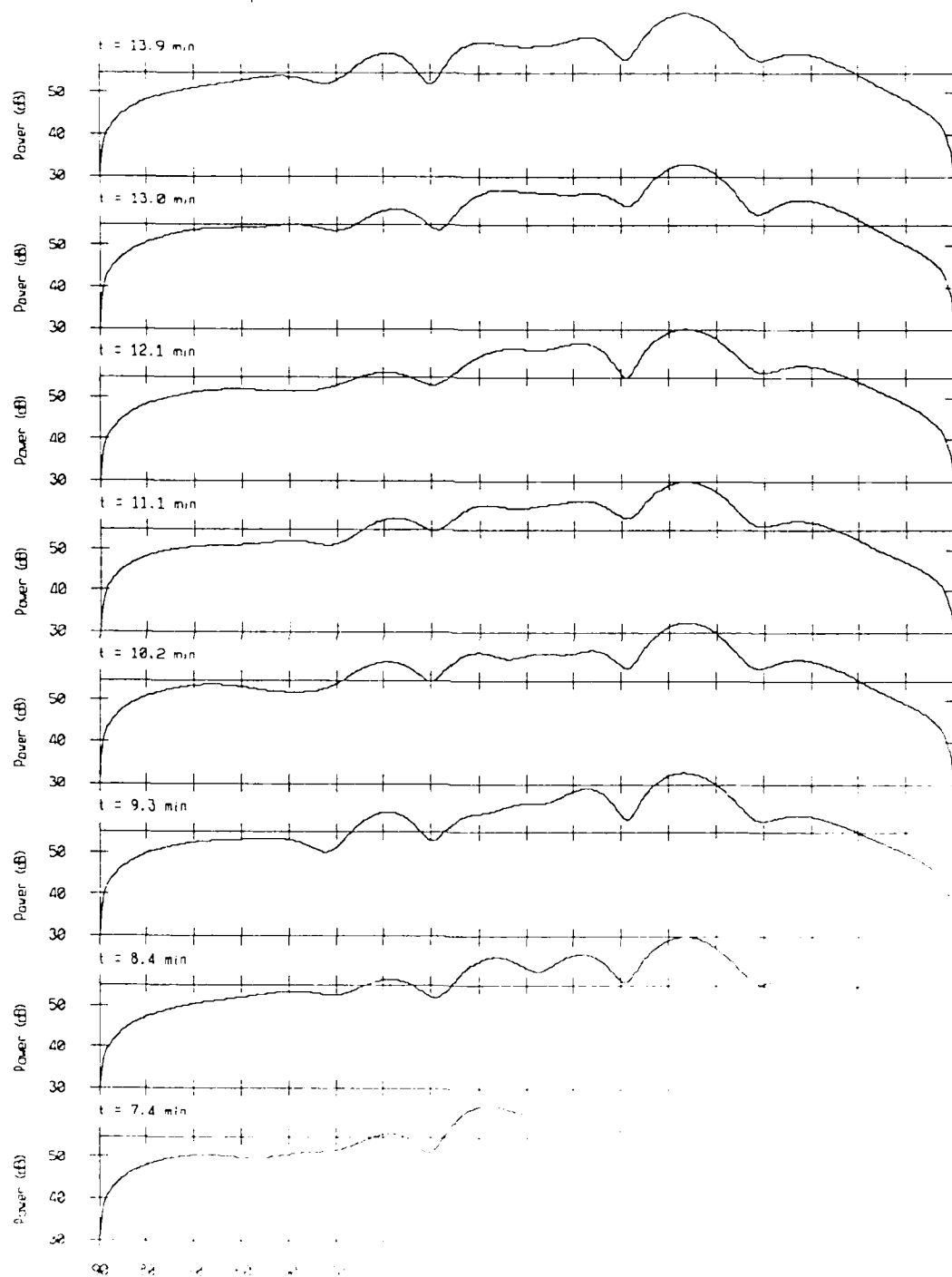
Array Response - 86060 Bin #4619

$f = 75$ Hz, rect window



Array Response - 86060 Bin #4619

$f = 75$ Hz, rect window



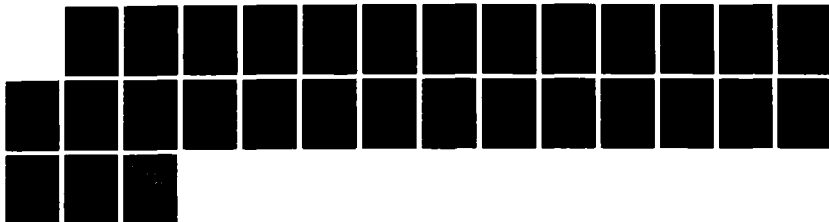
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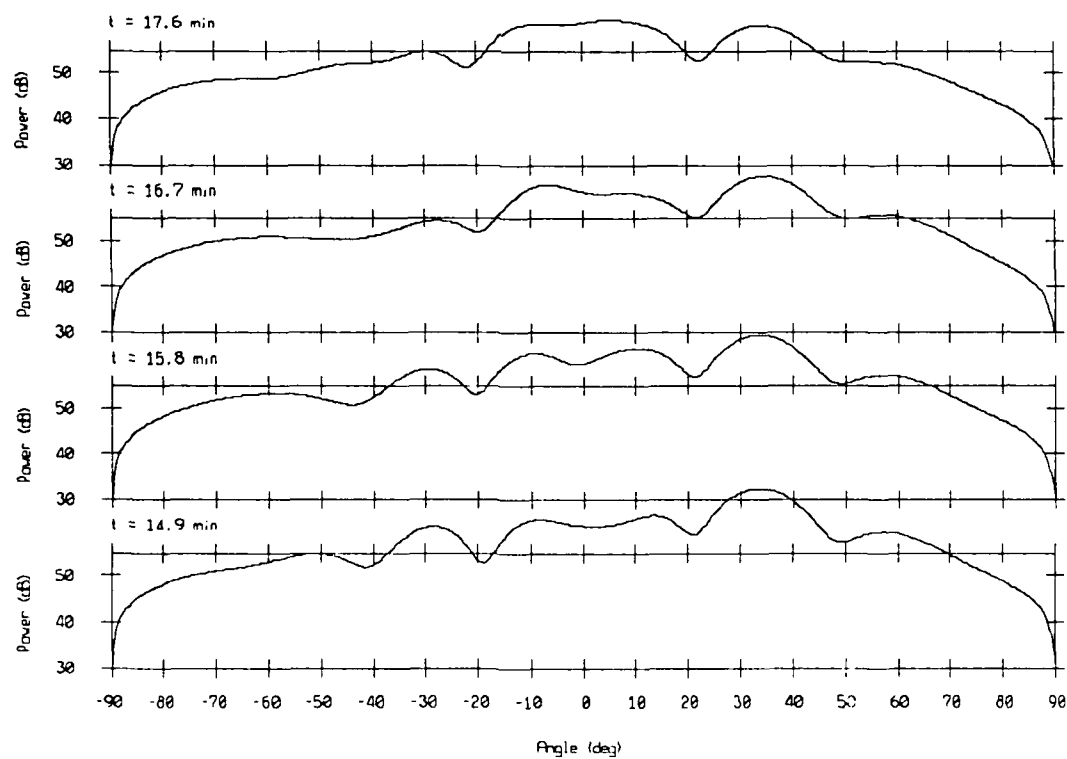




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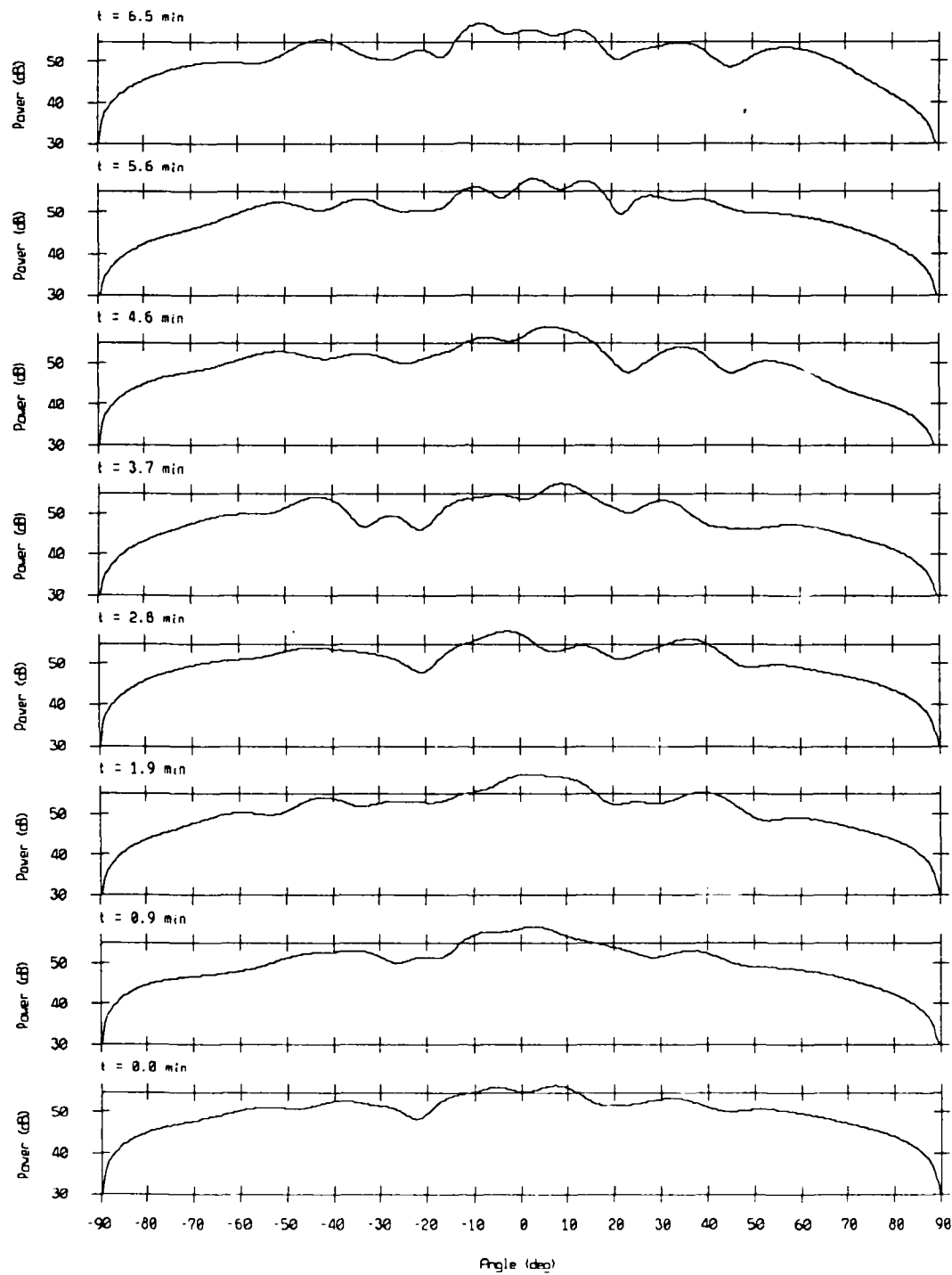
Array Response - 86060 Bin #4619

$f = 75$ Hz, rect window



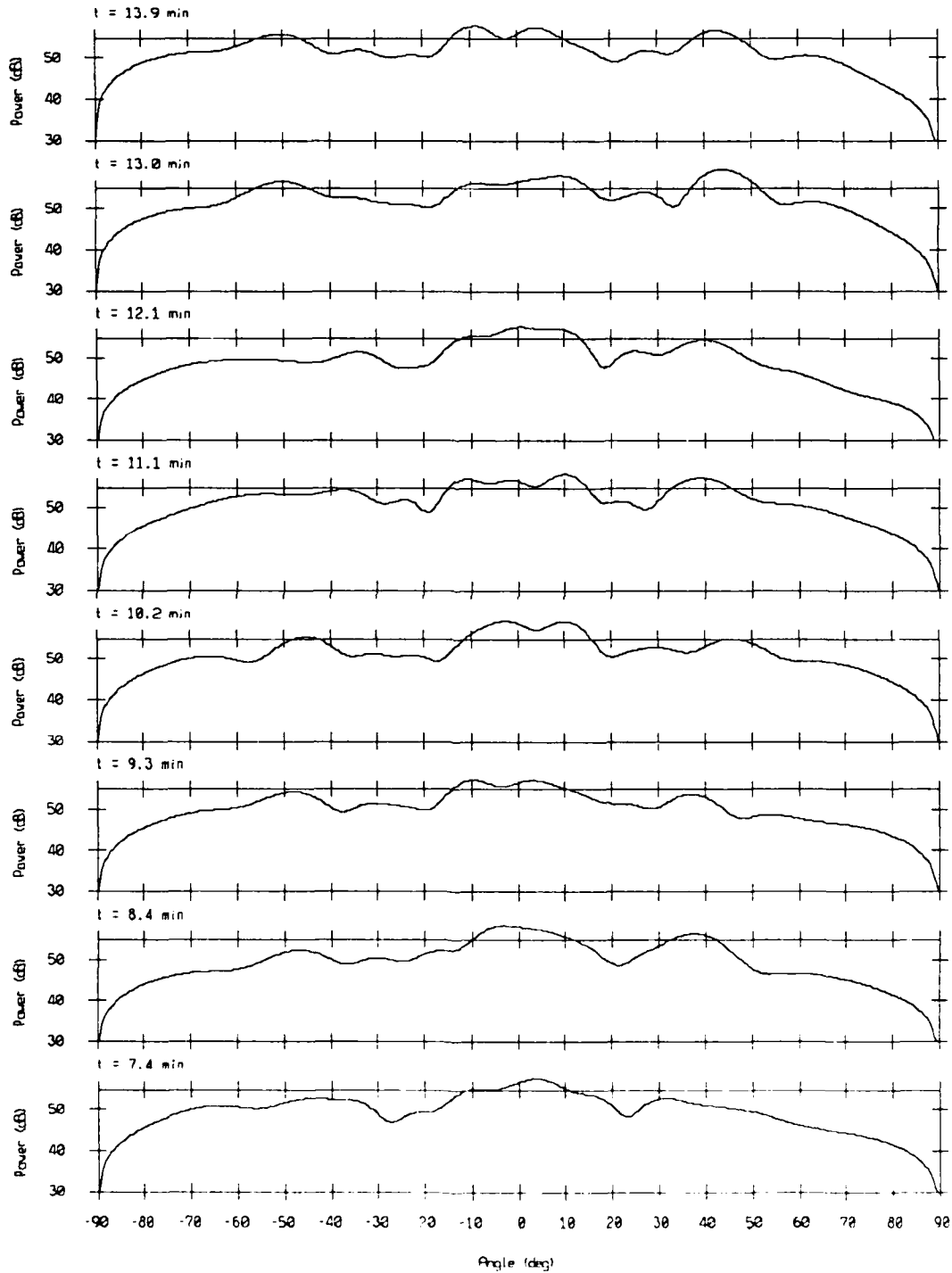
Array Response - 86060 Bin #4793

$f = 100$ Hz, rect window



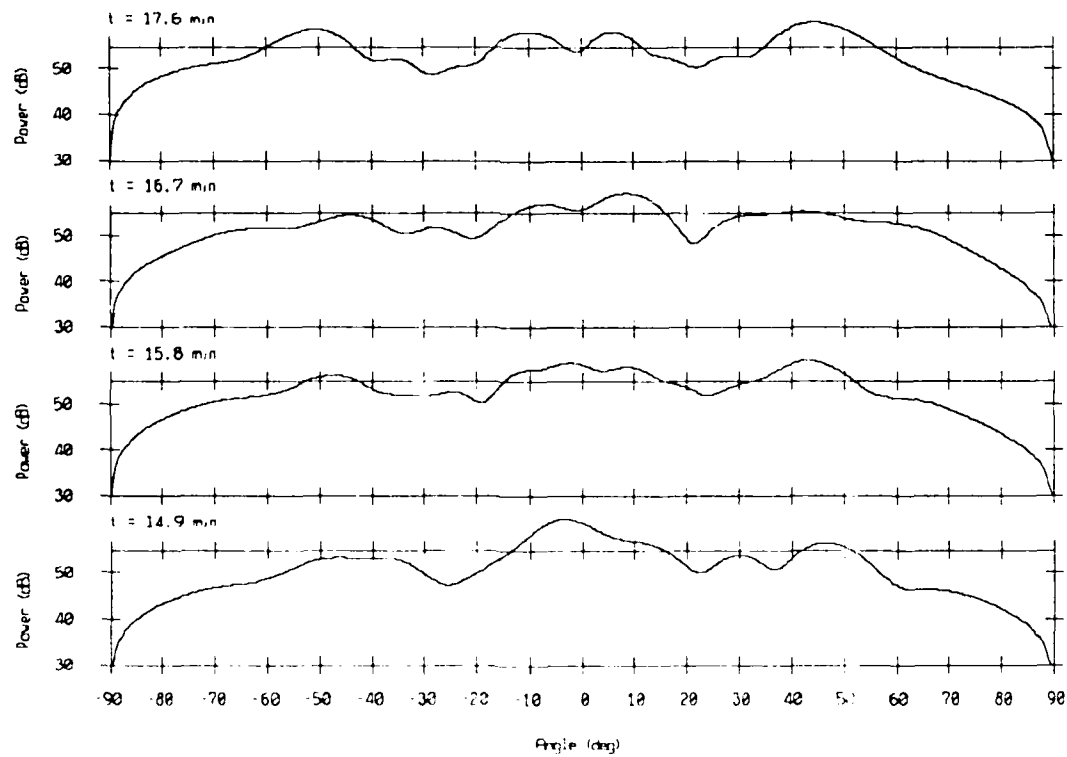
Array Response - 86060 Bin #4793

f = 100 Hz, rect window



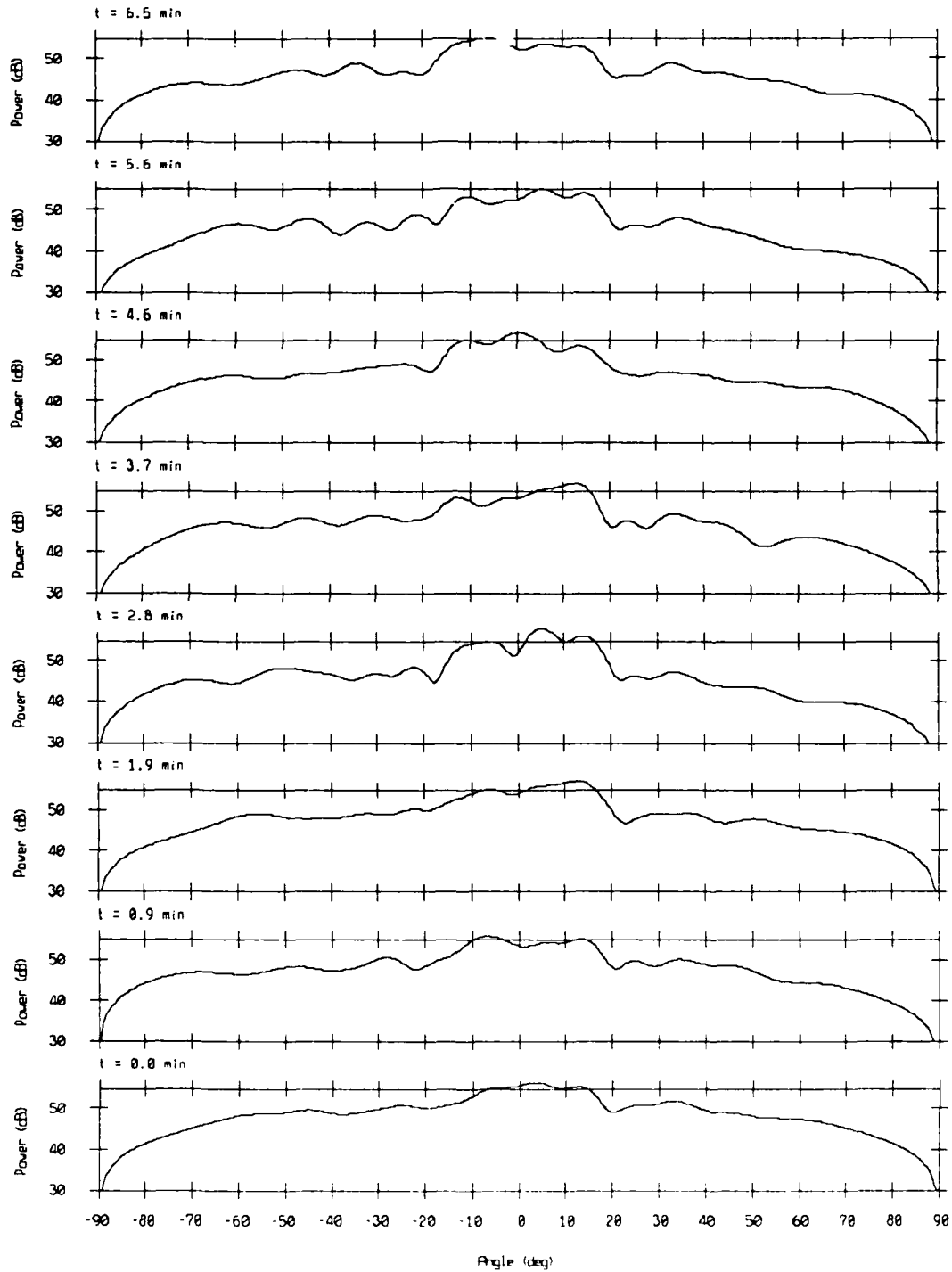
Array Response - 86060 Bin #4793

$f = 100$ Hz, rect window



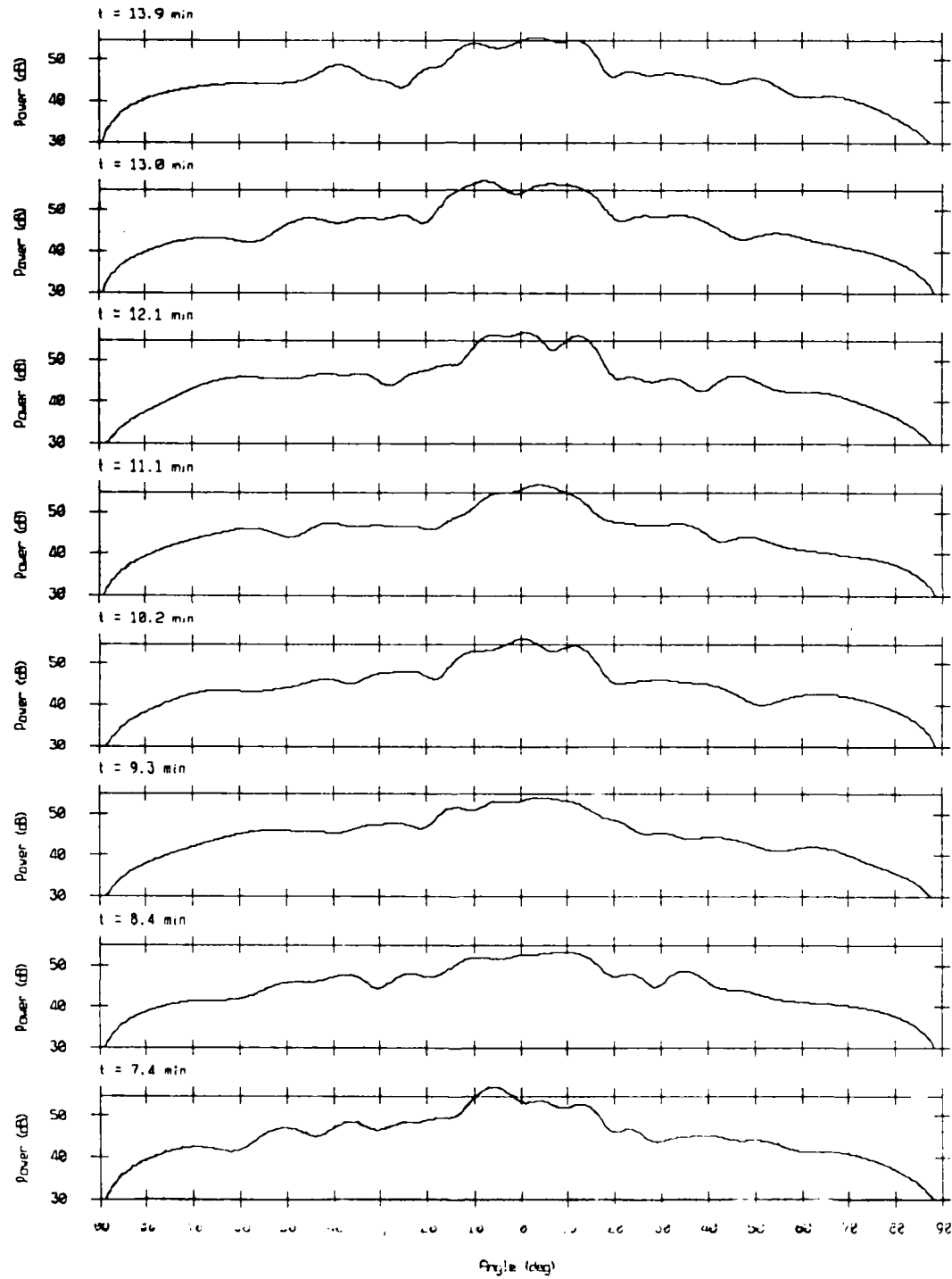
Array Response - 86060 Bin #4967

$f = 125$ Hz, rect window



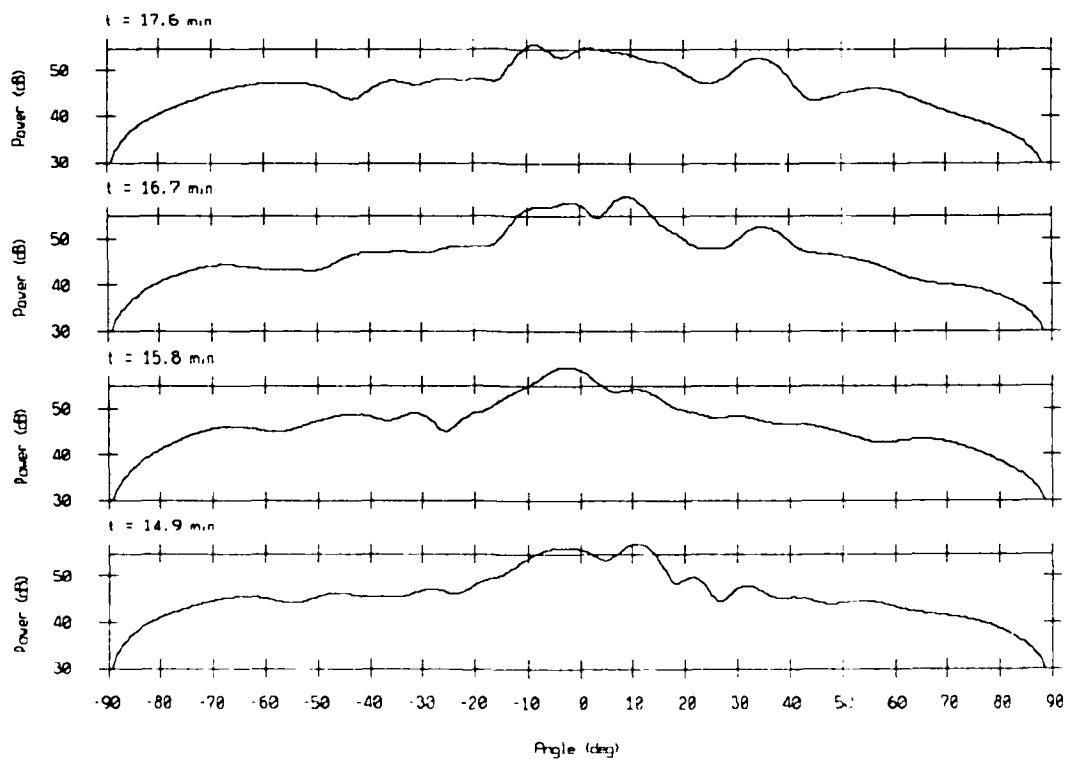
Array Response - 86060 Bin #4967

$f = 125$ Hz, rect window



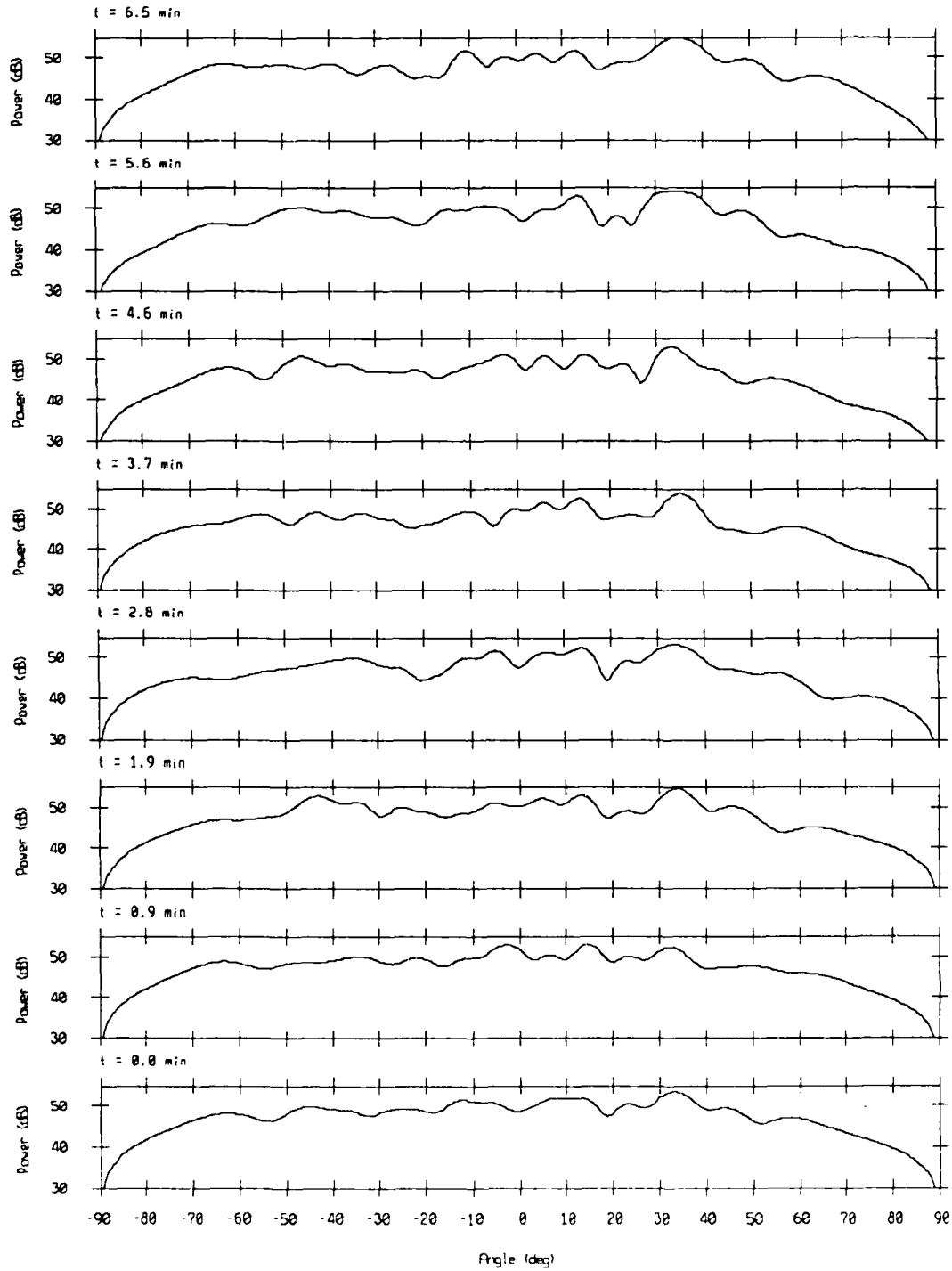
Array Response - 86060 Bin #4967

$f = 125$ Hz, rect window



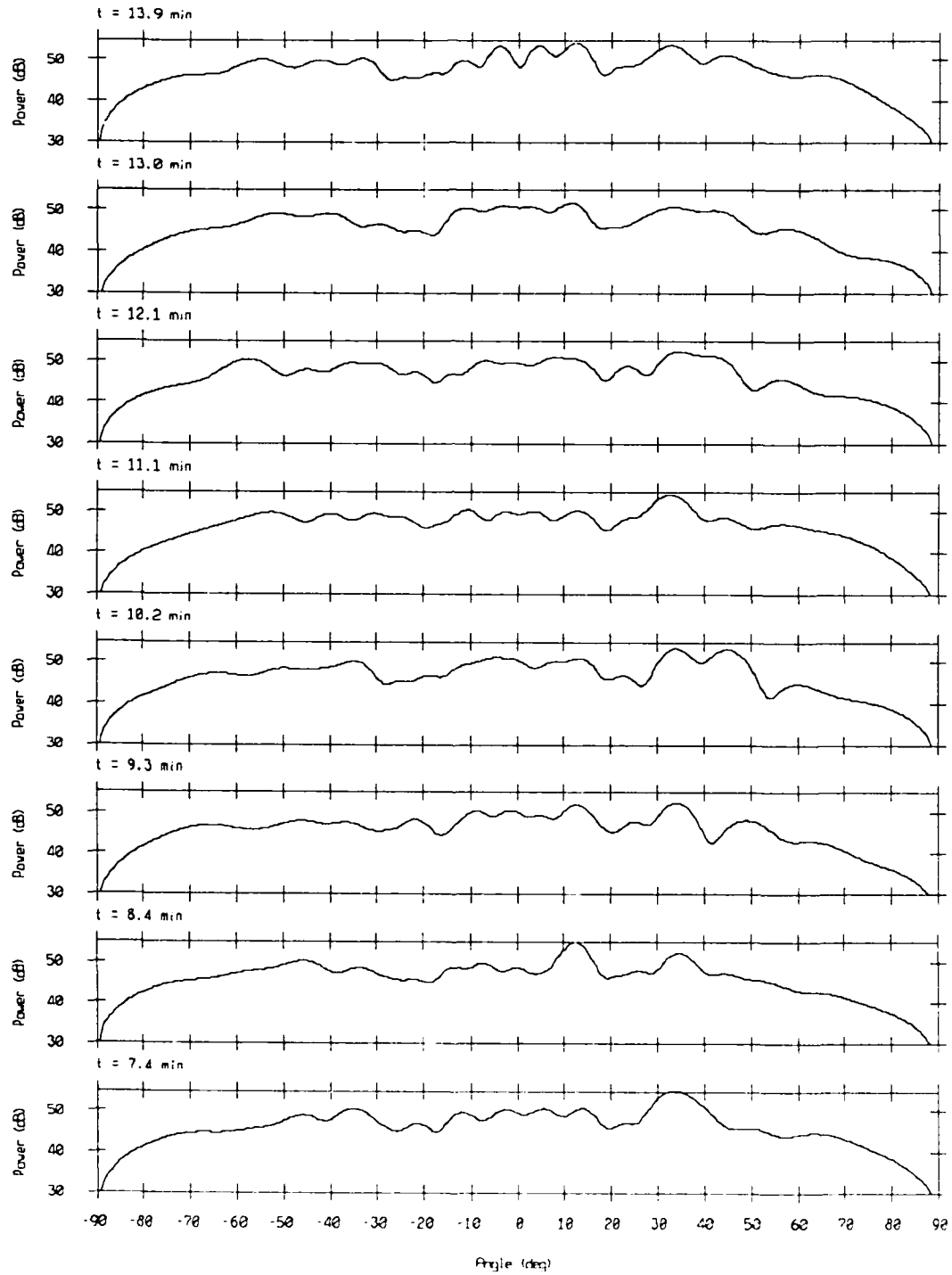
Array Response - 86060 Bin #5141

$f = 150$ Hz, rect window



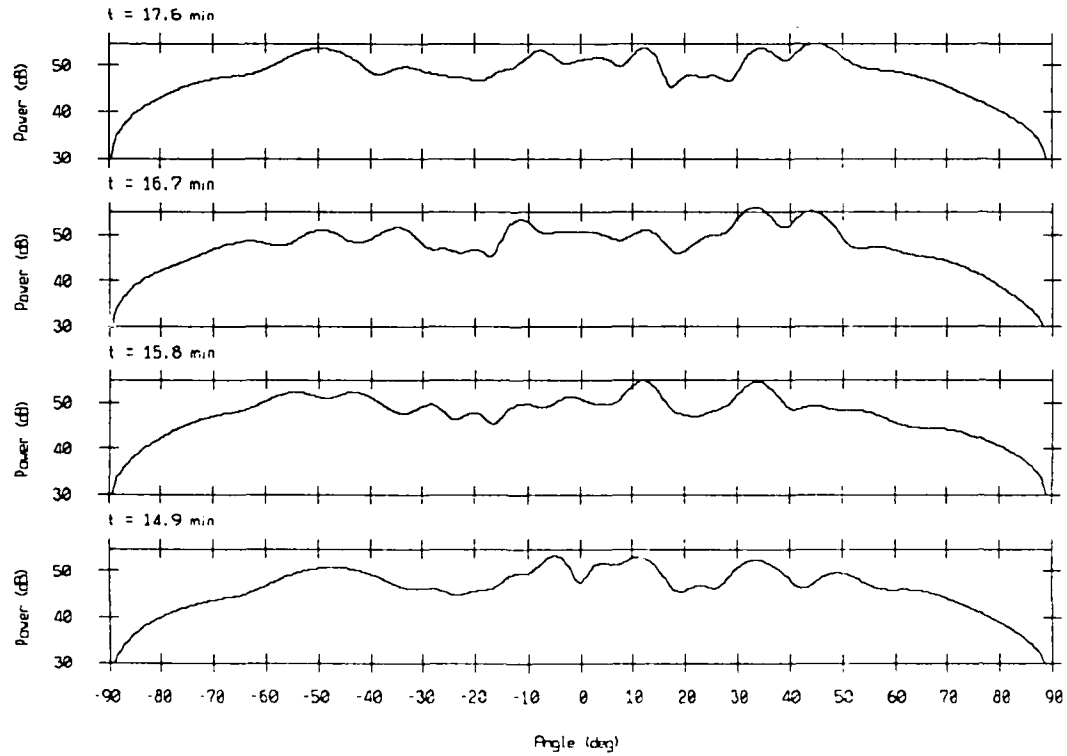
Array Response - 85060 Bin #5141

$f = 150$ Hz, rect window



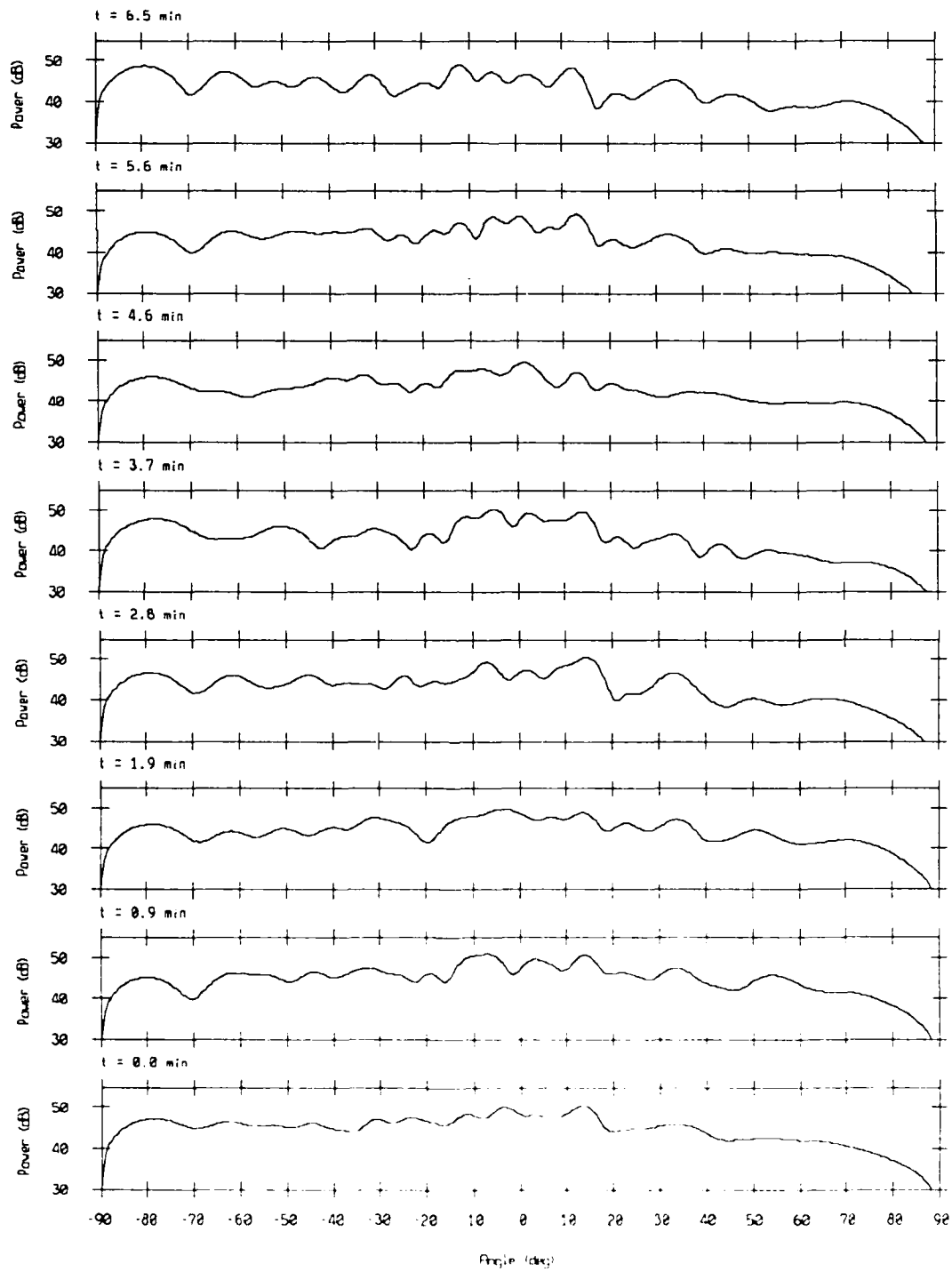
Array Response - 86060 Bin #5141

$f = 150$ Hz, rect window



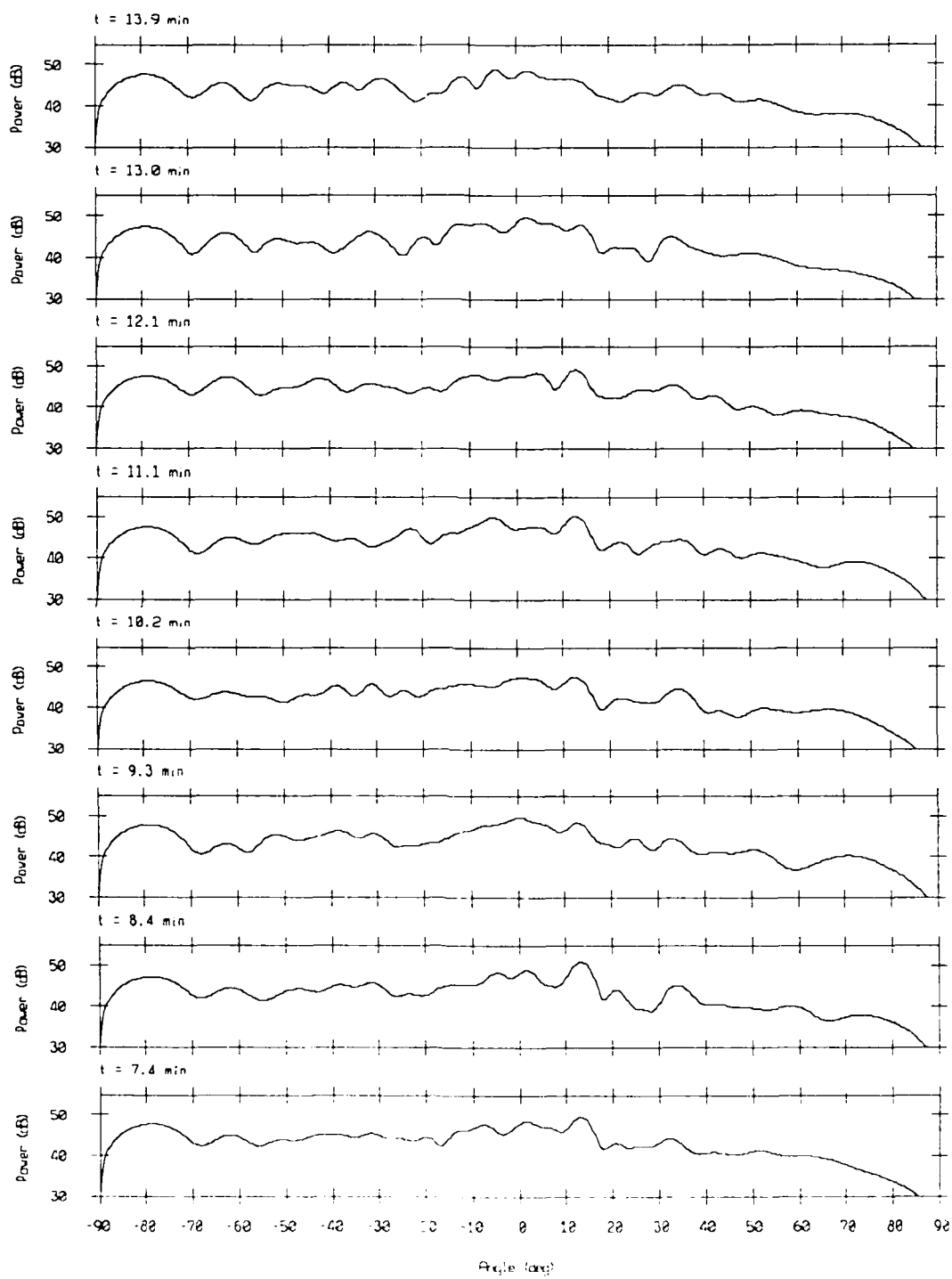
Array Response - 86060 Bin #5316

$f = 175$ Hz, rect window



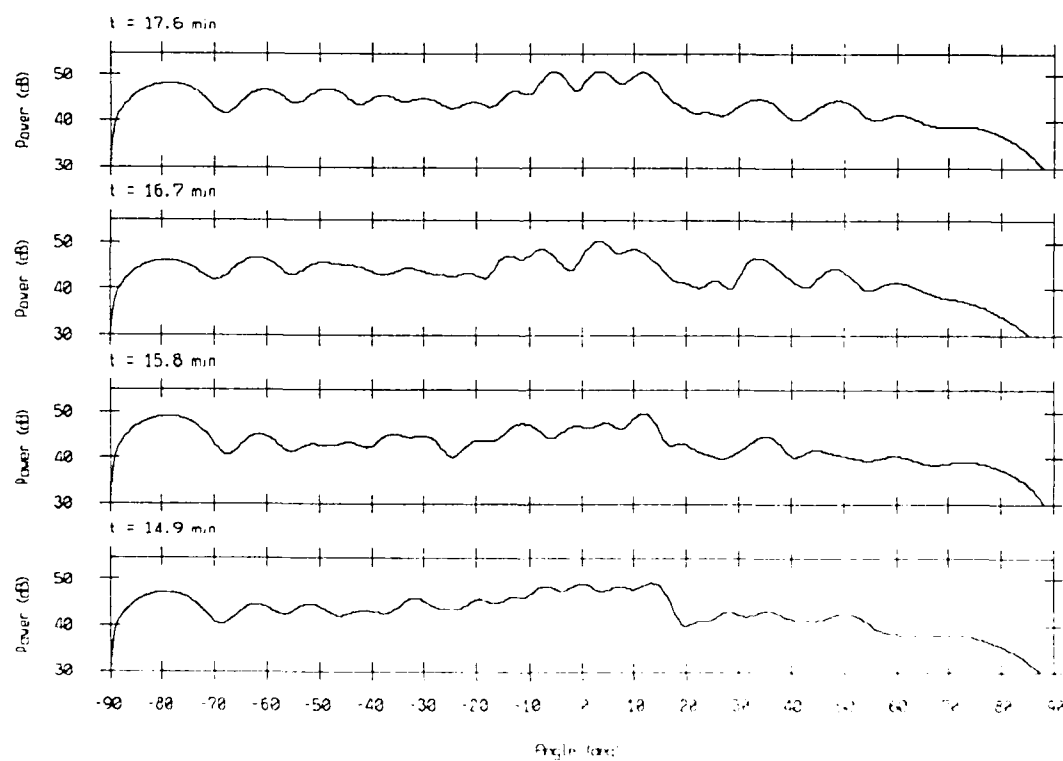
Array Response - 86060 Bin #5316

$f = 175$ Hz, rect window



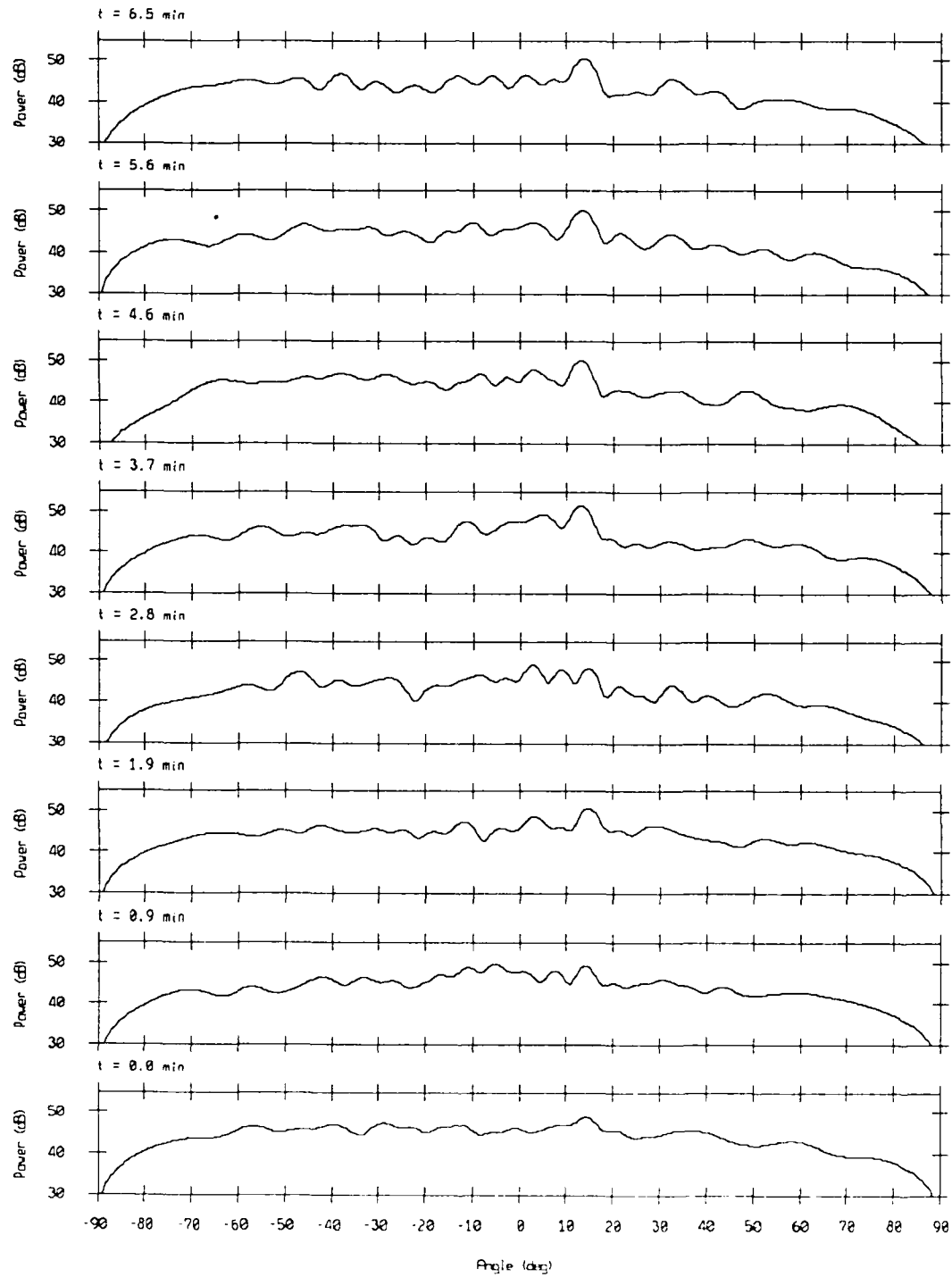
Array Response - 86060 Bin #5316

$f = 175$ Hz, rect window



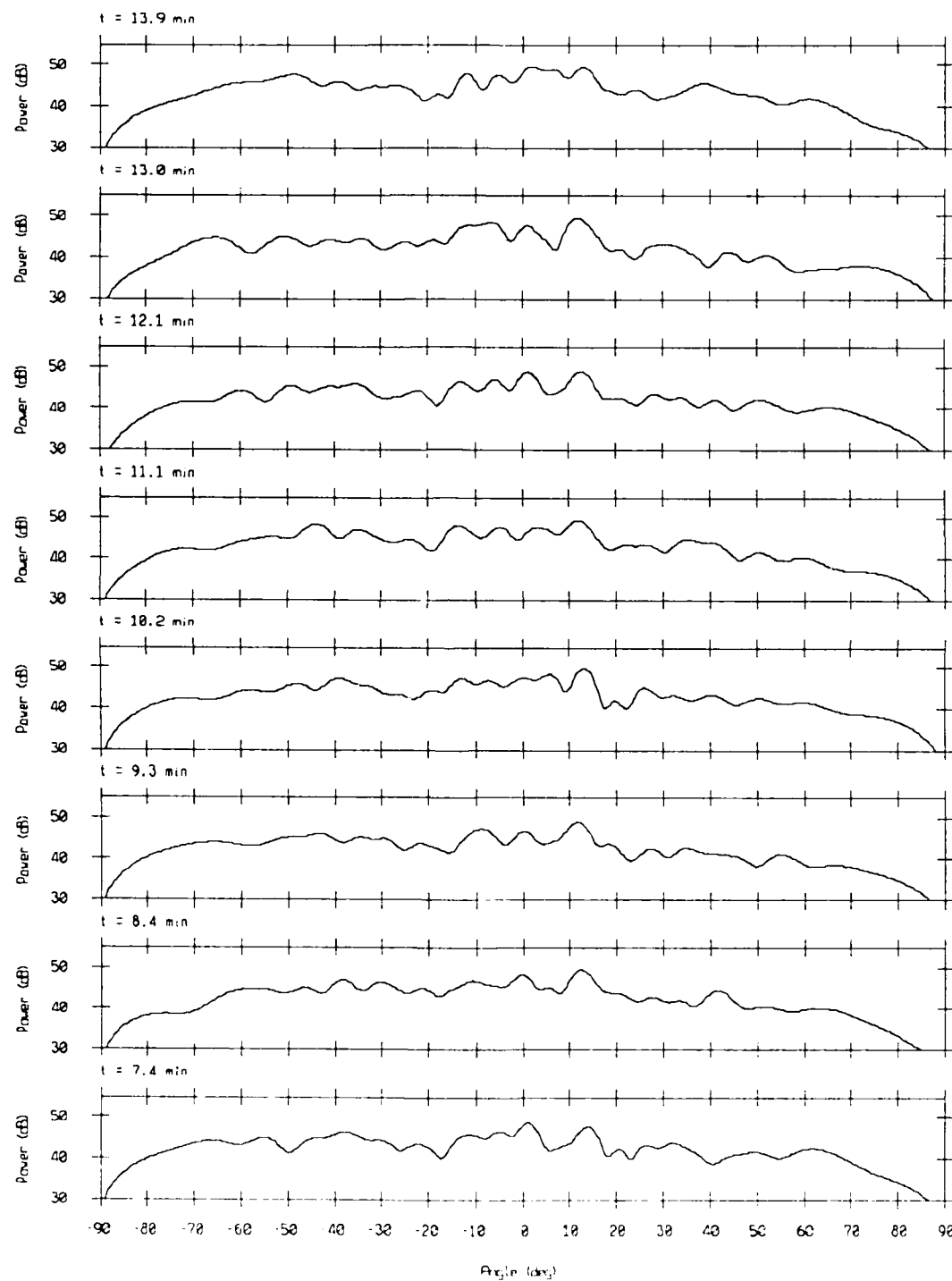
Array Response - 86060 Bin #5490

$f = 200$ Hz, rect window



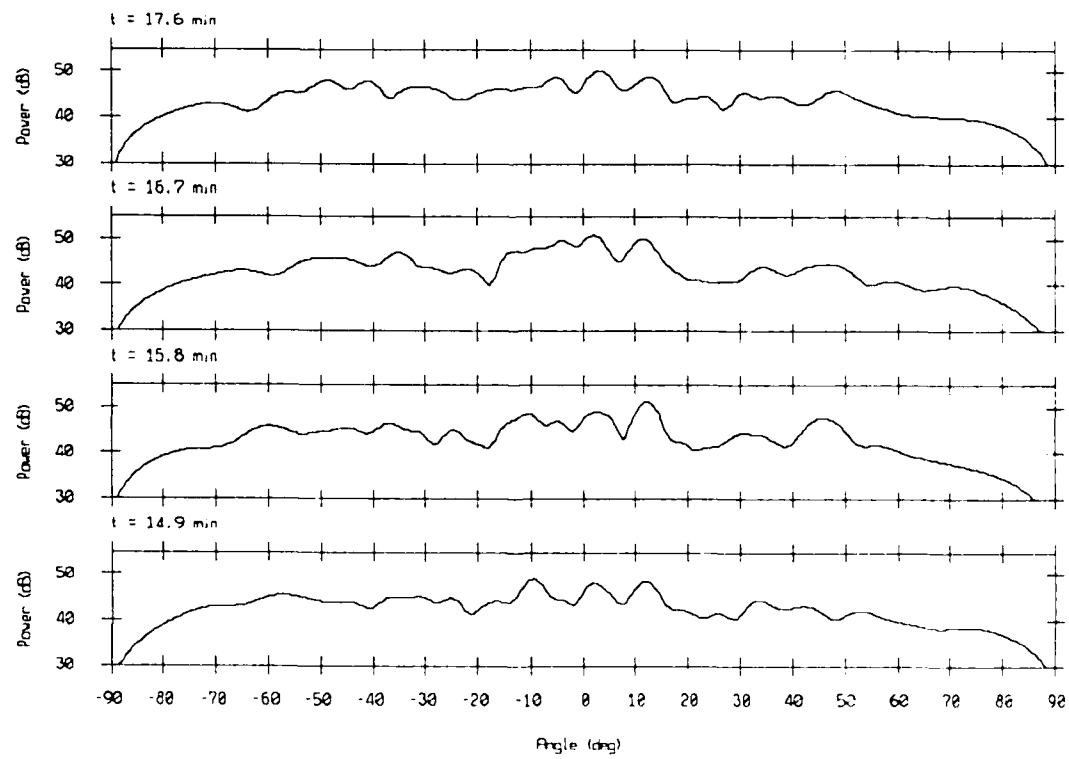
Array Response - 86060 Bin #5490

$f = 200$ Hz, rect window



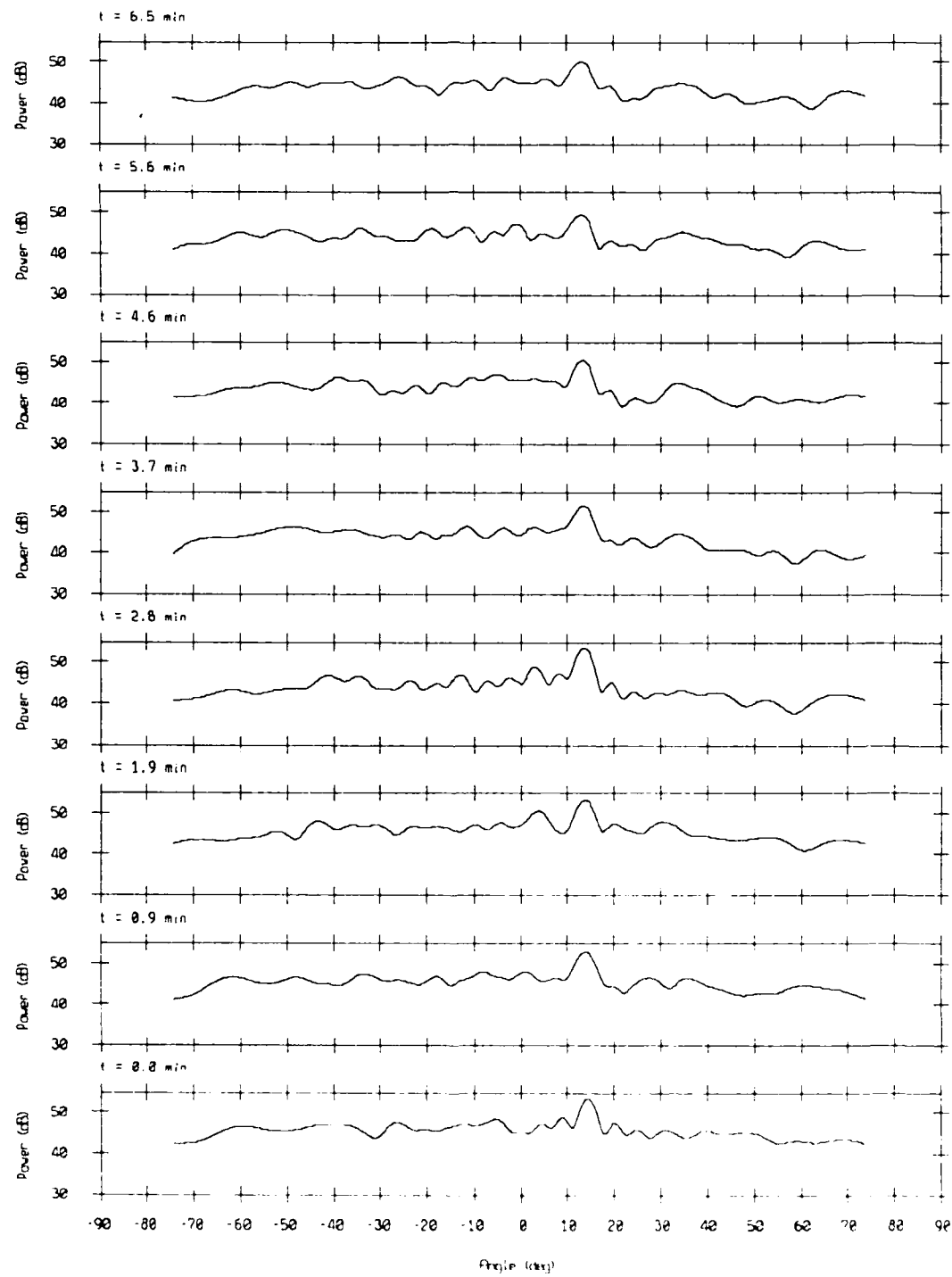
Array Response - 86060 Bin #5490

$f = 200$ Hz, rect window



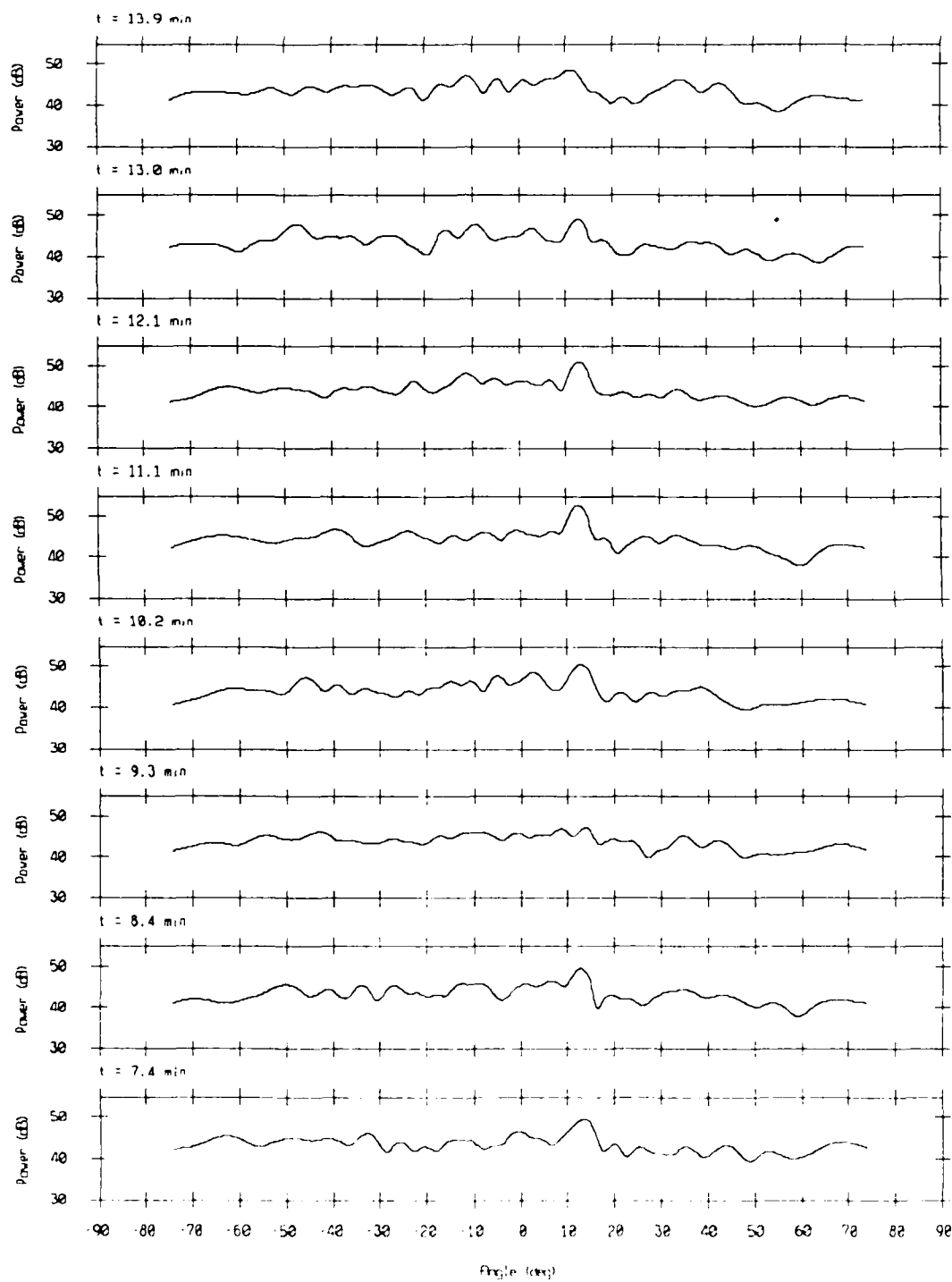
Array Response - 86060 Bin #5664

$f = 225$ Hz, rect window



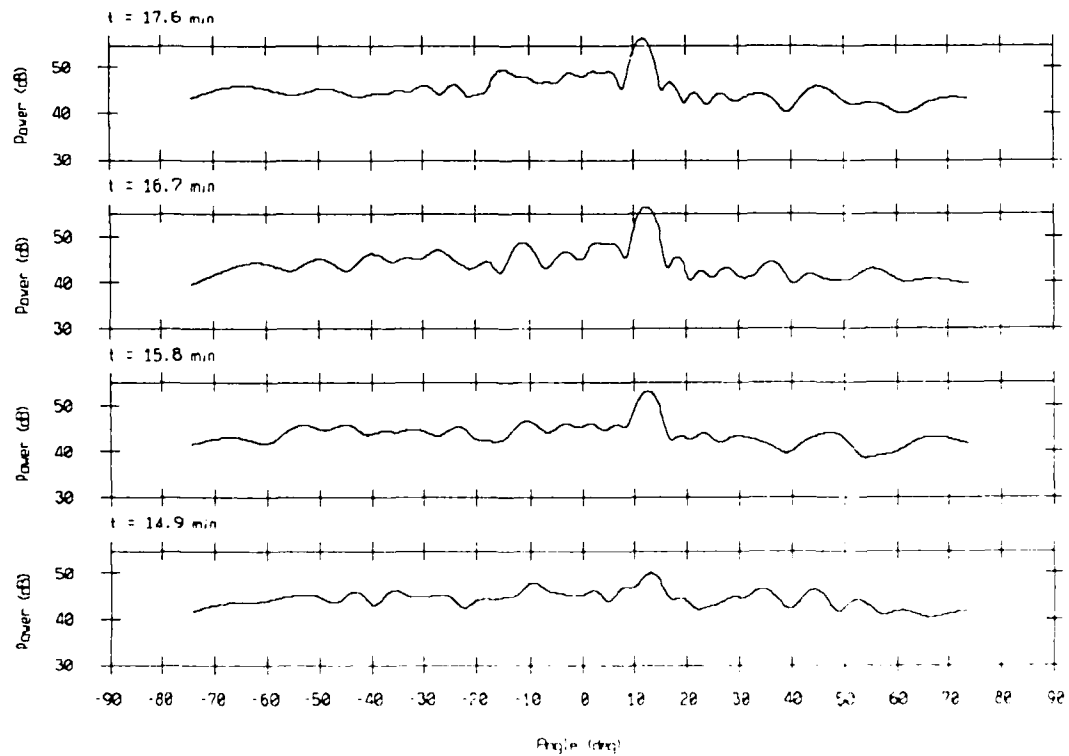
Array Response - 85060 Bin #5664

$f = 225$ Hz, rect window



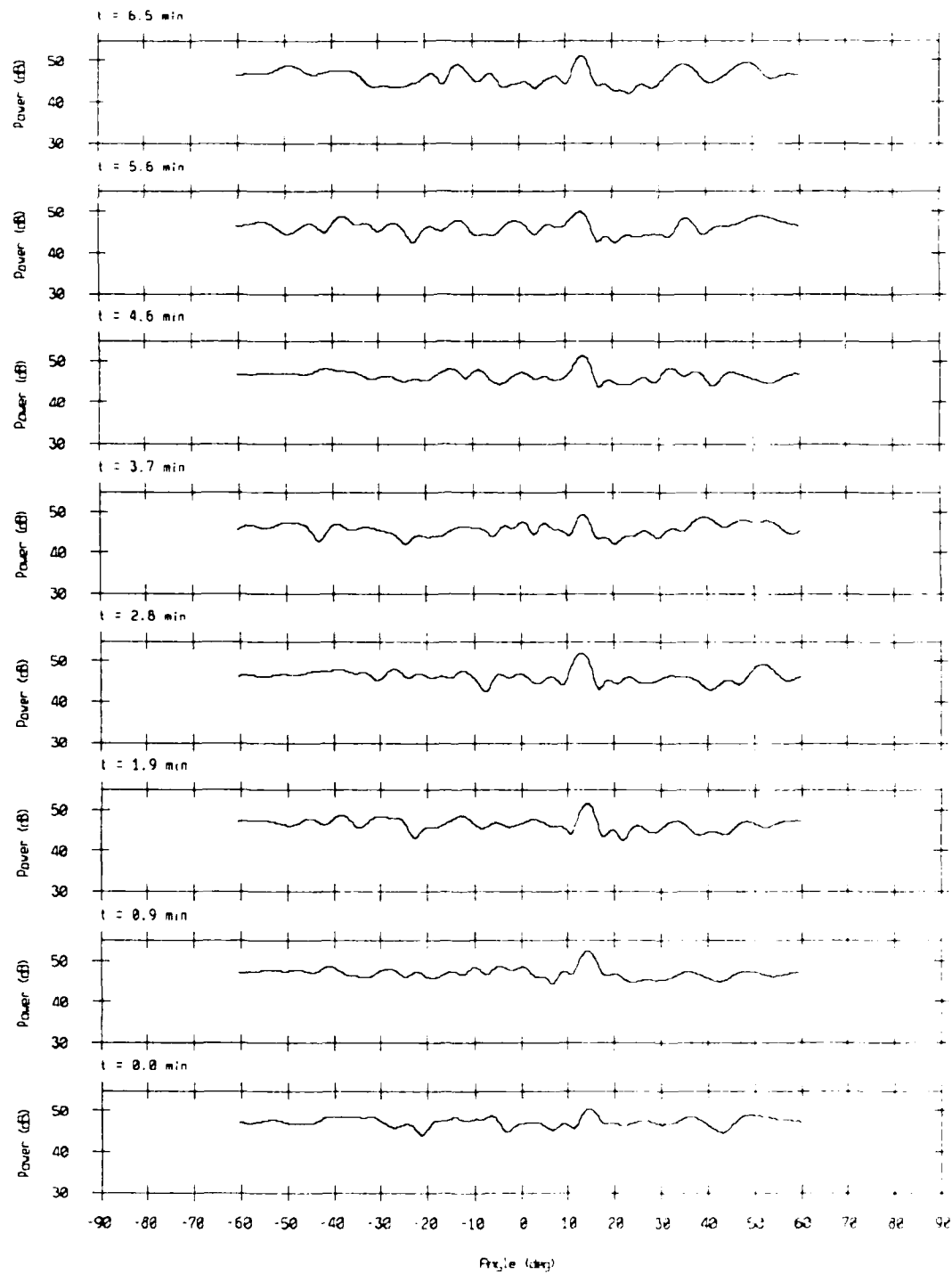
Array Response - 86060 Bin #5664

$f = 225$ Hz, rect window



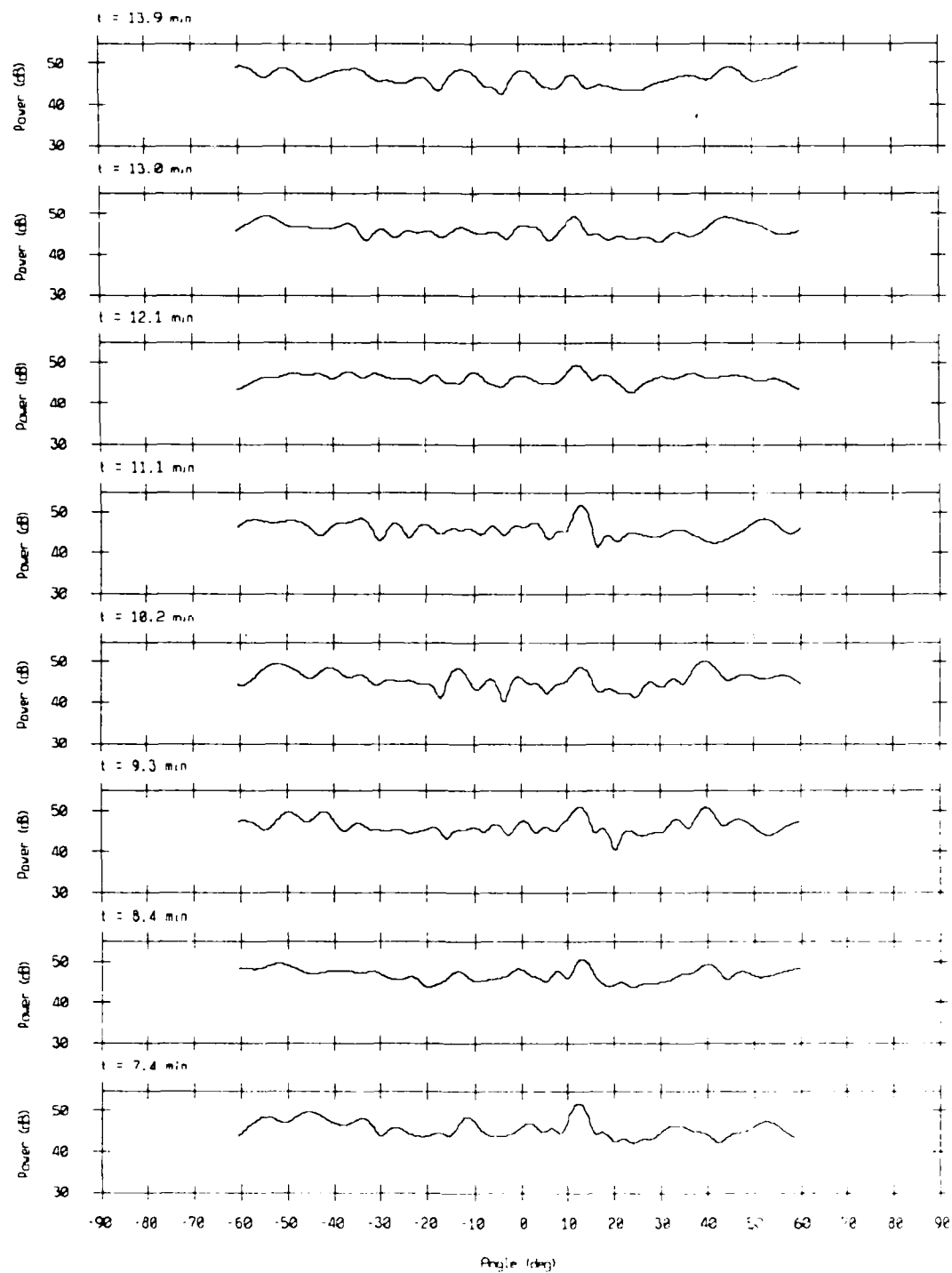
Array Response - 86060 Bin #5832

$f = 250$ Hz, rect window



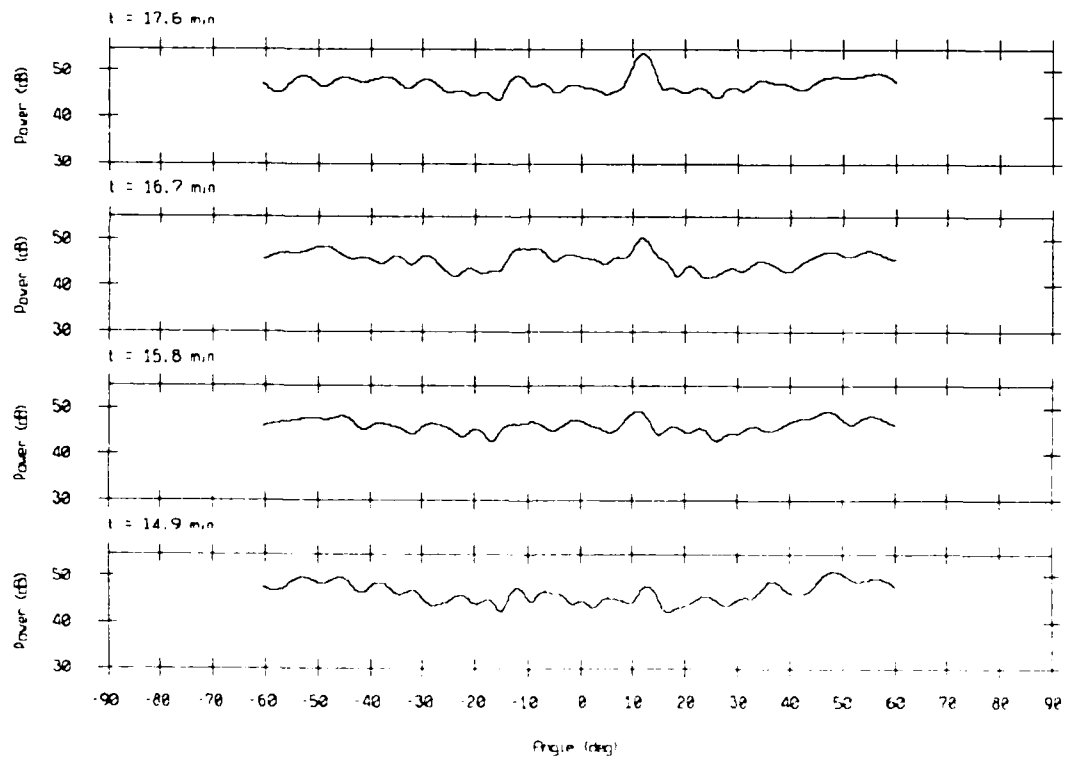
Array Response - 86060 Bin #5832

$f = 250$ Hz, rect window



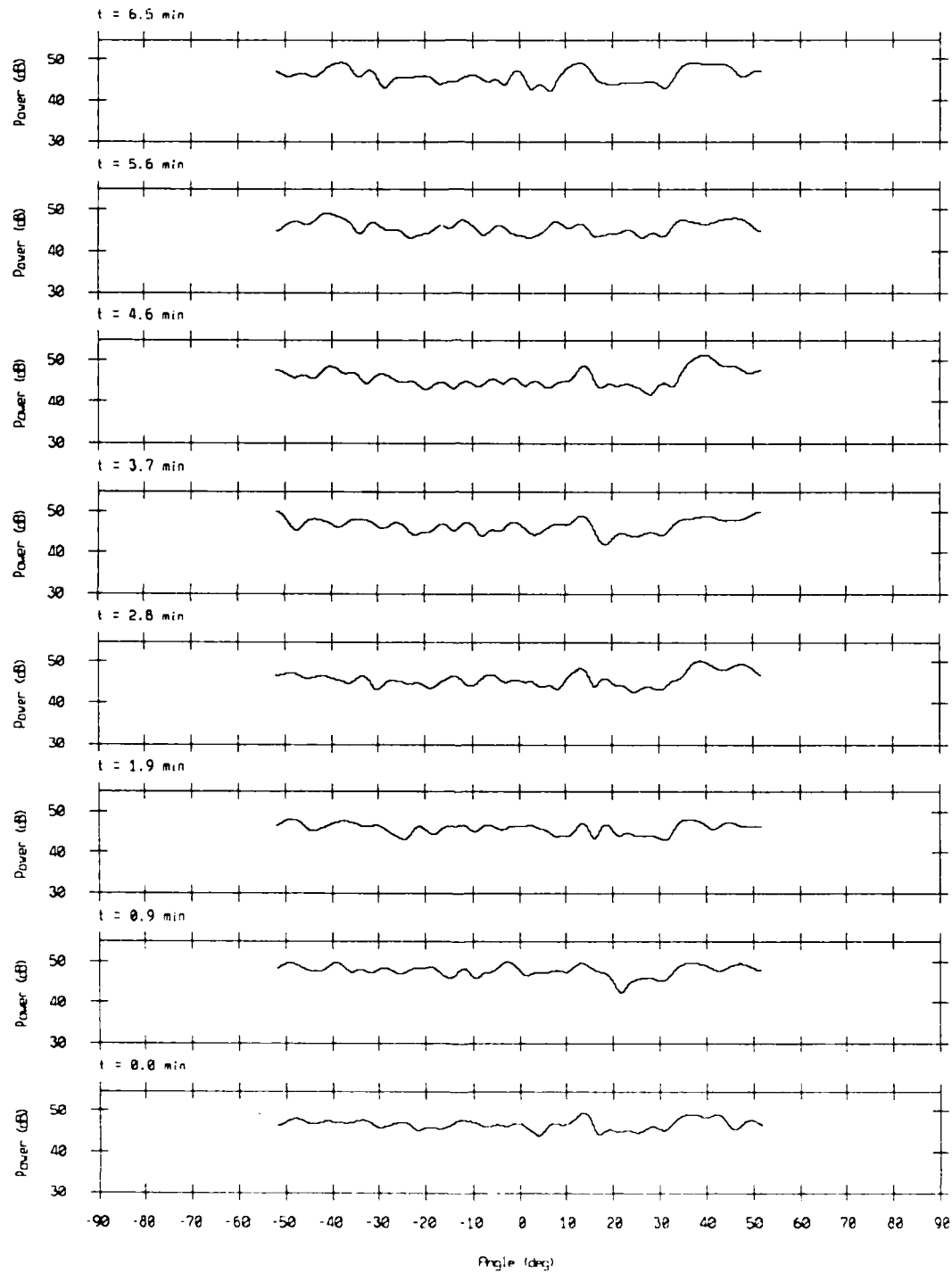
Array Response - 86060 Bin #5832

$f = 250$ Hz, rect window



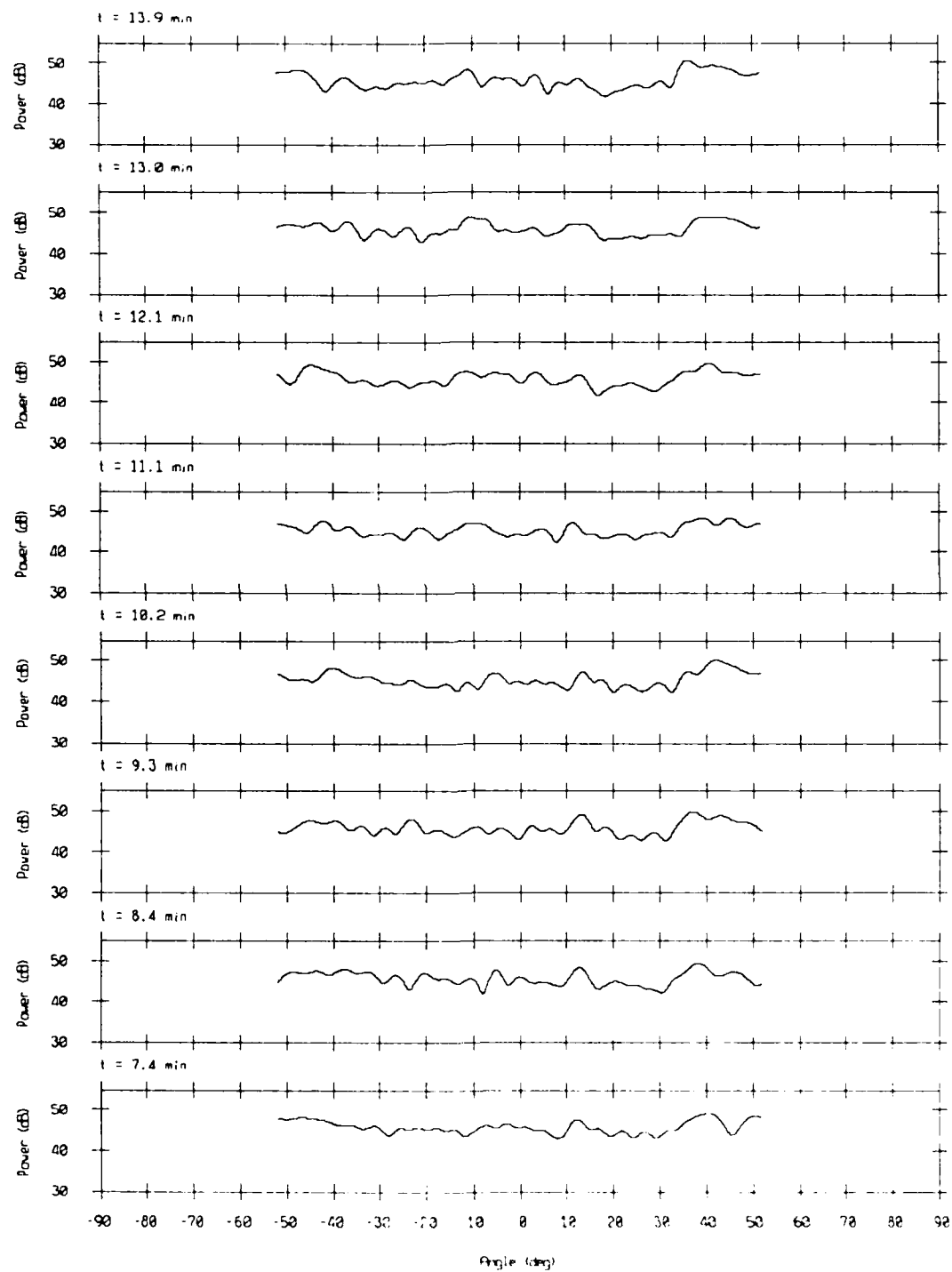
Array Response - 86060 Bin #6012

$f = 275$ Hz, rect window



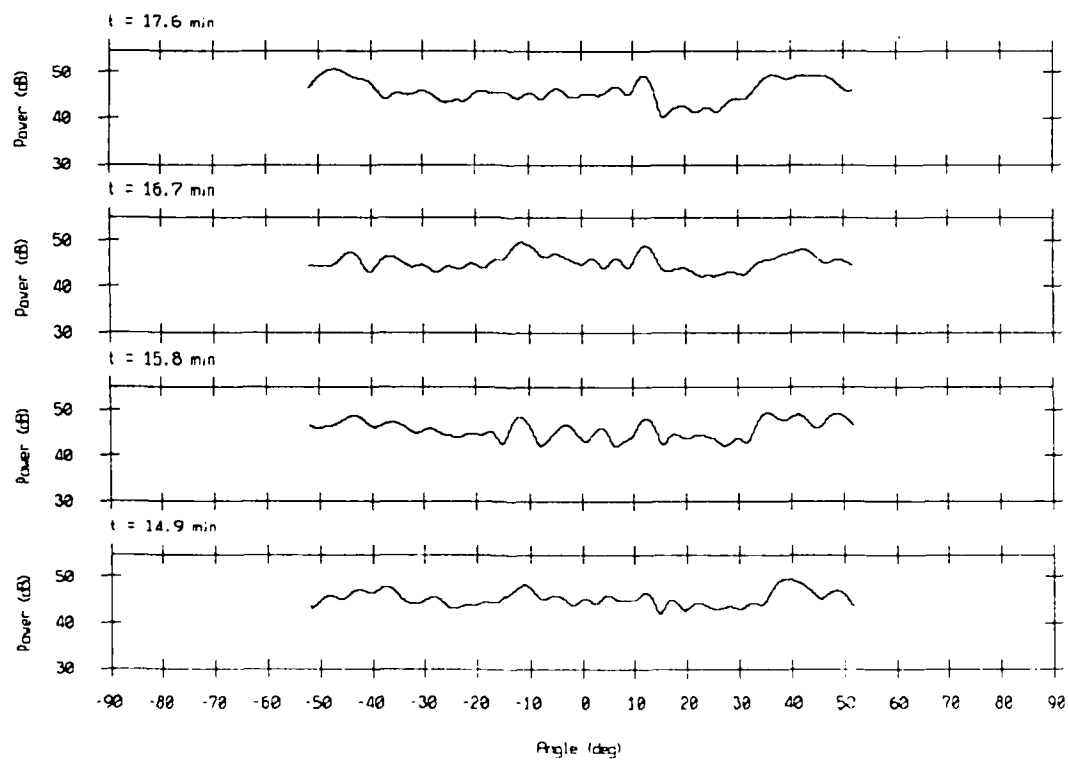
Array Response - 86060 Bin #6012

$f = 275$ Hz, rect window



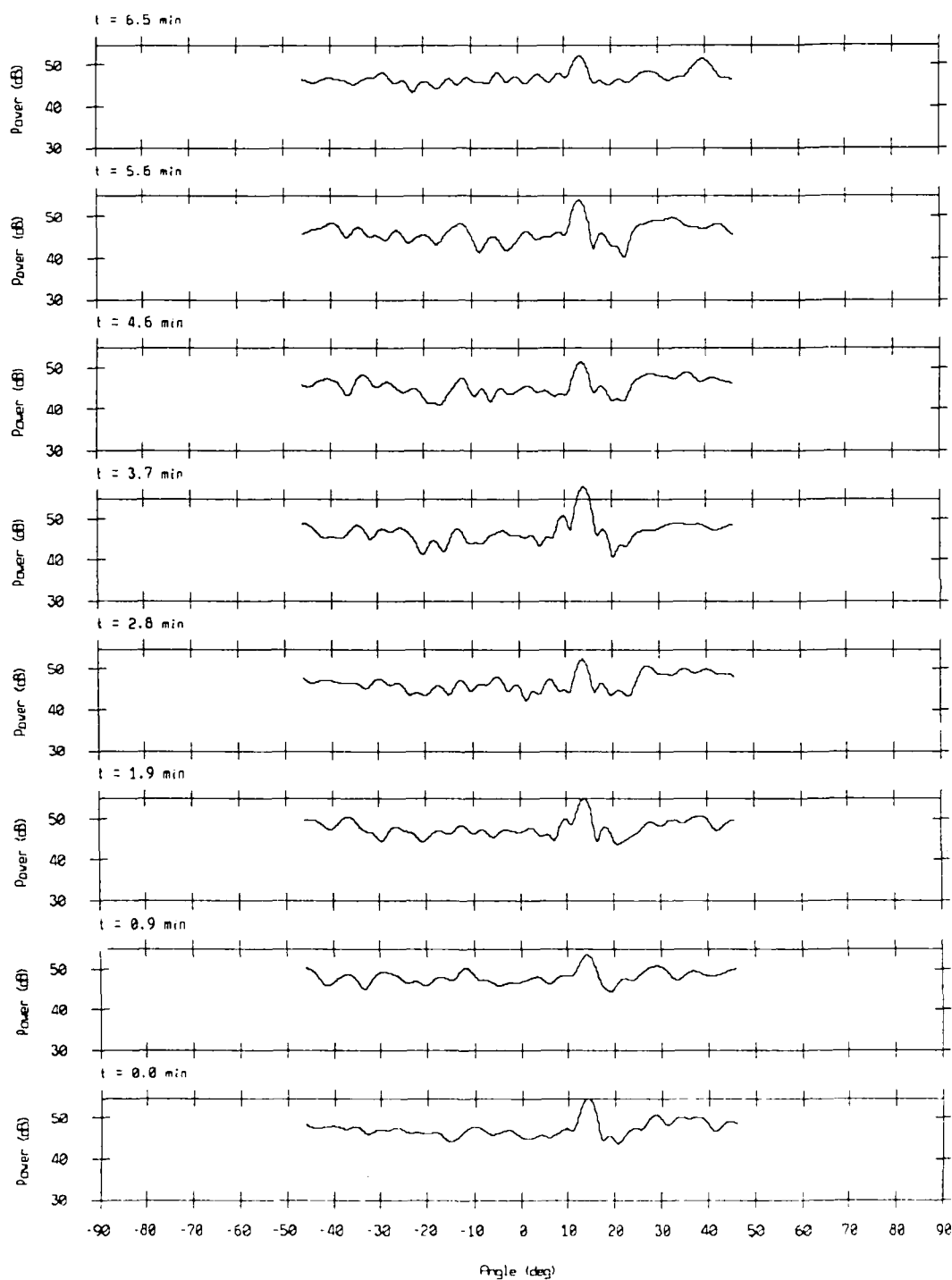
Array Response - 86060 Bin #6012

$f = 275$ Hz, rect window



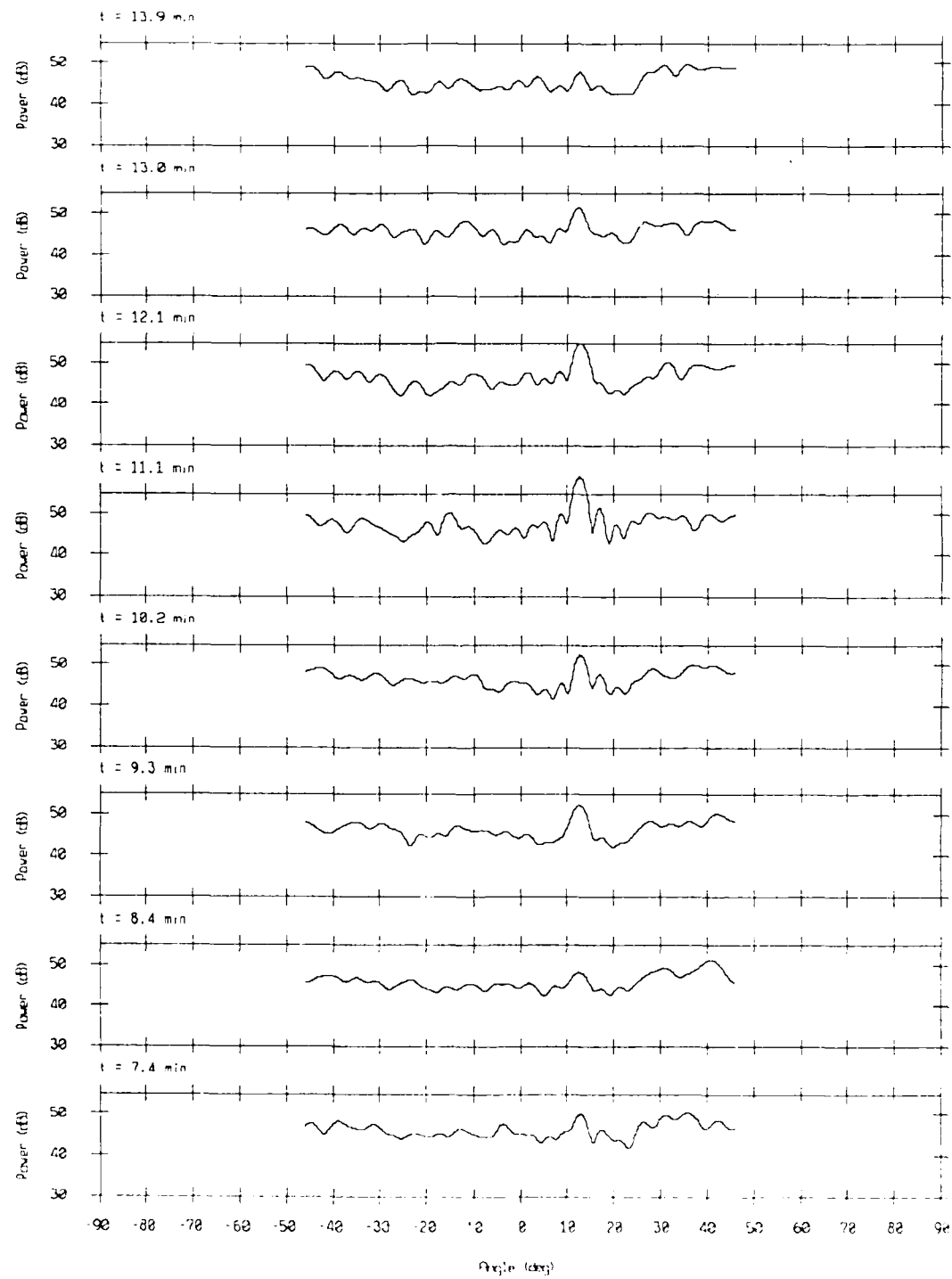
Array Response - 86060 Bin #6186

$f = 300$ Hz, rect window



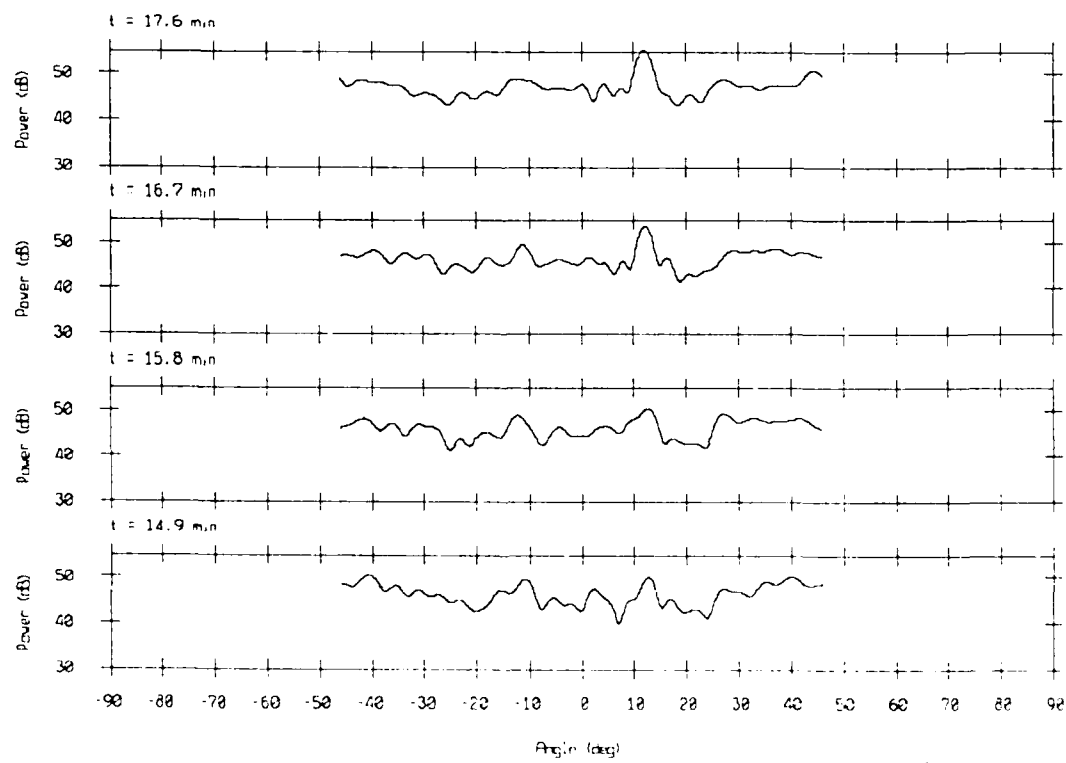
Array Response - 86060 Bin #6186

$f = 300$ Hz, rect window



Array Response - E5060 Bin #6186

$f = 300$ Hz, rect window



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